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BRIEFLY TOLD.

PROGRAMME, FIRST ANNUAL MEETING, CANADIAN GAS ASSOCIATION.—We are indebted to the courtesy of Mr. A. W. Moore, Secretary of the Canadian Gas Association, for information that goes to prove beyond a doubt that its first meeting, set for Friday and Saturday of this week, in the King Edward Hotel, Toronto, of the Canadian Gas Association, is to be equal to the best hopes of its founders and promoters. The papers promised are:

"Producer Gas Fired Benches," by Mr. W. H. Pearson, Jr.
"Coal Tar and Ammonia," by Mr. W. J. Keillor.
"Gas Appliances," by Mr. C. Forbes, Ottawa.
"Commercial Side of the Industry," by Mr. L. S. Bigelow.
"Producer Gas for Power Purposes," by Mr. E. J. Phillips.
"Experiences with Canadian Coals," by Mr. R. A. Wallace.

This surely is a promising list. In fact it would do exceeding credit to many an older Association. President Powell's address can also be counted on to fittingly head the proper programme, for the Brantford man keeps well in touch with that that is going on which has to do with the lighting industry of our adjoining brothers. Secretary Moore also announces a nicely arranged programme of entertainment, the main features of which are: Friday luncheon at the Royal Canadian Yacht Club, Toronto Island. Friday evening, visit to Scarborough Beach. Saturday morning, visit to the large modern plant of the Consumers Gas Company. Do not fail to arrange for your housing in advance.

TESTING GAS METERS AND REPORTING THE RESULTS.—We have no doubt that the Public Service Commission for the First District of New York had no intention of even seeming unfairness in having prepared for the daily press a synopsis of the results of the testing of gas meters as carried out under the direction of the Commission. But it does not seem to us at all fair that, from the figures thus given, any paper should be able to publish a statement similar in manner to this, which appeared in the columns of the New York *Evening Post*, of June 9th. The main heading to the article was: "Gas Meter Tests for May," and the sub-heading was: "Out of 668 Complained of Only 87 Were Found to be Correct." Then the body of the article gives in detail the results of the tests, which to the careful reader, of course, show the relative numbers, and percentages, fast, slow and correct. The average newspaper reader, especially in respect of an article of this sort, will not go beyond the headlines, and he, therefore, puts his paper down under the impression that less than 13 per cent. of the meters tested were accurate, with by far the greater number registering against the consumer. The exact truth, however, of the tests over the stated number tested is as follows: Of the 668 meters, 87 were found to have responded to an accuracy of 100 per cent., 138 were found less than 1 per cent. fast, and 102 were less than 2 per cent. fast, or a total of 327 (49 per cent.) within the limit prescribed by the statutes. Of the remainder, 244 (or 36.5 per cent.) were found over 2 per cent. fast, and 97 (or 14.5 per cent.) were found over 2 per cent. slow. These figures go clearly to prove the unfairness of the headlines of the *Post*, and as that paper is usually fair-minded and fair-doing, the damage done is all the more regrettable, especially as its readers on the average are rather well up in the mental and social scale. Why not have the Commissioners state their findings in the clear manner that is followed by the Massachusetts Board of Gas and Electric Light Commissioners in its dealings with the meter testing division of its work. In the Massachusetts reports one will find plainly stated the number of meters slow, the number of meters fast, and the number correct within the limits, not restricting the word "Correct" to mean only an absolute accuracy of 100 per cent. This would be a good matter for the close attention of the Empire State Gas and Electric Association, and possibly the Society of Gas Lighting could fittingly unbend a trifle over the case.

THINGS USEFUL AND ORNAMENTAL.—The editor's desk has been the temporary resting place recently of many things that are ever useful, and the fact that they are frequently ornamental adds to their effectiveness. To describe these properly would require much space, but it is certainly due the senders that some acknowledgment of their courtesy be made. For instance, there is a copy of a catalogue, labeled D, issued by the H. Mueller Manufacturing Company, of Decatur, Ills., and New York city. This mammoth book is certainly a wonderful example of compiling and a marvel in its usefulness to the purchasing agents of gas companies and gasfitters. Of course, its listings have to do only with the goods made and sold by this sterling house, and its get up is in thorough keeping with the way in which the Mueller's

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always do things—never by halves. The book is completeness itself, and despite its size, it is easy to go through by means of an excellent external ready reference system of initialing. Further, although it is weighty, the serviceability of its beautiful binding guarantees long life to it, with even indifferent care. We do not think we are wide of the mark in saying that no other catalogue issued by any other house in any other line may be said to surpass it. It is the second year of its publication.

To the courtesy of the *Gas World*, London, England, we are indebted for its latest volume in the teaching line, entitled "Self-Instruction for Students in Gas Supply," the object of which, as its title implies, is "To assist those students who are contemplating studying for the examinations of the City and Guilds of London Institute on the subject of gas supply." An examination of its contents reveals quickly the fact that it is well calculated for such purpose, wherefore it would certainly seem useful to those on this side of the water who are either going through or contemplating a start in the course of the Practical Class under the guidance of the American Gas Institute. Nor need its usefulness be confined to such, for it can certainly fill a useful place in the reference books carried in the collection of any gas engineer.

A third number is the useful Bulletin, form 253, recently issued by the Gas Machinery Company, of Cleveland, O. It has to do with those portions of the machinery of a coal gas plant that have to do with exhausting, condensing and scrubbing. The excellence of the descriptive test is strongly enhanced by several clear, clean and excellently engraved pictures, and the simplicity of its readiness to aid comprehension is accentuated by a number of original diagrams, the working out of which must have taken many thoughtfully busy hours. At least 5 of these diagrams are original in every sense, and it would not surprise us to know that they represent the thought of and were traced by the facile pen of Mr. Pierre Plantinga.

The fourth reminder is in the shape of "Bulletin No. 210, B.," from the "brain division" of the Western Gas Construction Company. Like all that issues from its "Press Division," in design, typography, illustrations, paper and press work, it is all that could be desired by anyone. As to its material accomplishings we think the best acknowledgment respecting it is to admit that the Company has admirably succeeded in accomplishing that which it claims to have tried to do, as told in the first paragraph of the letter that accompanied the sample of the "Bulletin," that was sent to us. That claim was: "In selecting a subject for the inclosed 'Bulletin,' we have been prompted by two principle reasons: First, to keep the subject of water gas apparatus to the front; second, to explain in short and concise form the changes of conditions of fuel, oil and apparatus during the 'blow' and 'run' periods."

Another reminder from the "Western" is a third of the series of desk blotting pads that have been sent out from Fort Wayne. The others were pretty; this is absolutely beauty itself—no; to be accurate, it is beauty in the plural. Send for one and see for yourself.

The last reminder to be noted is the handsome catalogue issued some time ago by the Cruse-Kemper Company, of Ambler, Pa. It is an excellent specimen of printing and binding, and the illustrator could not have done better with his subjects. Excellent photographic reproductions in half-tone work well show how the Company carried out several of its past contracts in the instance of holders, the largest of which is a triple-lift vessel. Other illustrations have to do with various pieces of apparatus recently erected by it, such as purifiers (a circular set, 14 feet deep by 24 feet diameter, is shown), cone-hoppers, girders, oil storage tanks and the like.

CURRENT COMMENT.—

THE last meeting of the Illuminating Engineering Society, New England Section, was held last Friday in the auditorium of the Edison Building, Boston. A large audience listened attentively to the paper of the evening, by Mr. H. M. Daggett, Jr., which paper dealt understandingly and at length on "High Efficiency Illuminants." The comparisons presented respecting the relative efficiencies of tantalum and tungsten lamps, as compared with gas arcs and inverted gas lamps, were certainly brimful of interest. The session was the last one until that part of autumn which marks the finish of the vacation season is reached.

MR. CHARLES F. CATTELL, of West Chester, Pa., has taken out a charter for the right to construct and operate a gas plant in the rapidly growing district of Renova, Clinton county, Pa., a compactly built district, housing over 6,000 people.

THE vertical benches of the Dessau system, which are handled in this country by the Didier-March Company, under the direction of Mr. Frederick J. Mayer, seem to be finding increasing favor with the best European gas engineers. Proof of this is at hand, for orders for 39 benches, holding 390 retorts, have been placed within the last 90 days. The benches so far constructed number 222, carrying 2,270 retorts, and it has positively come to our knowledge that several installations of this type are being seriously considered in America.

[No. IV.]

Review of the Twenty-third Annual Report, Board of Gas and Electric Light Commissioners, Commonwealth of Massachusetts.

[Prepared for the JOURNAL by MR. H. THURSTON OWENS.]

Surplus.—The aggregates of the balance sheets show total assets amounting to $55,270,896.74, being an increase of something over $3,000,000. The total liabilities, including reserved and depreciation funds, amounts to $49.345,999.97, leaving a surplus of $5,924,896.77, or ½ million larger than 1906. The surplus and reserve represent an equivalent of about 22 per cent. of the capital employed, or 1 per cent. greater than the previous year. In the case of the electric light plants the surplus represented the percentage of the capital employed of 10.63 per cent. in 1906, and 12.14 per cent. in 1907.

Sendouts.—The report includes a statement covering the daily capacity of works, the greatest and least output and the dates for each of these sendouts. Only 9 plants exceeded their capacity on their largest day, so that there does not appear to be any liability of a gas famine, even should the commercial engineers and new business managers continue to develop the field as rapidly and successfully as they have in the past.

Eight companies exceeded the 1 million mark on their greatest daily output, and one company (Boston) on the least.

The date of the largest output was usually in December, as might be expected, but at Chicopee and Revere, which are summer resorts it was in June.

The tables following exhibit the general operating conditions as regards sales, unaccounted-for, percentages of increase, etc.

The sales by two companies amounted to over 5 million feet per mile of main—Boston and East Boston—this figure being only one-half that of London.

Five companies show over 300,000 feet of unaccounted-for gas per mile of main, and two of these companies are also among the five companies showing the largest sendouts per mile of main. Six companies show over 150 consumers per mile of main, and four of them are among the five showing the largest sendouts per mile of main.

Among the five companies which lead in the amount of pipe laid

	Per Mile of Main.			Gas Sold Per Consumer.
	Gas Sold.	Gas Unaccounted-for.	Number of Consumers	
TABLE A.—Companies Showing the Largest Amounts of Gas Sold per Mile of Main.				
East Boston	5,137,409	260,469	179.4	18,384
Boston*	5,039,368	194,183	141.0	30,781
Lynn*	4,222,921	324,350	159.4	26,486
Fall River	3,968,781	295,167	167.9	23,503
Cambridge	3,895,972	362,401	157.5	24,534
TABLE B.—Companies Showing the Largest Amount of Gas Unaccounted-for per Mile of Main.				
Cambridge (see Table A).	3,985,973	362,401	157.5	24,534
North Adams*	2,087,100	348,912	80.8	18,719
Milford	1,535,656	345,635	83.2	18,464
Lynn* (see Table A)	4,222,971	324,350	159.4	26,486
Charlestown	3,789,989	316,596	55.6	23,725
TABLE C.—Companies Showing the Largest Number of Consumers per Mile of Main.				
East Boston (see Table A)	5,137,409	260,469	179.4	18,384
Fall River (see Table A).	3,968,781	295.167	167.9	23,503
Nantucket*	1,652,470	231,402	164.1	10,050
Chelsea* (see Table F)	3,483,715	262,477	163.1	20,784
Lynn* (see Tables A & B)	4,222,971	324,350	159.4	26,486
TABLE D.—Companies Showing the Largest Amount of Gas Sold per Consumer.				
North Attleborough	2,586,597	50,043	73.6	35,142
Boston* (see Table A)	5,039,368	194,183	141.0	30,781
Worcester	3,526,261	246,132	119.1	29,204
Lowell	3,574,420	110,855	124.5	27,929
Athol*	1,224,856	66,289	45.4	26,976
TABLE E.—Smallest Amount, Gas Sold per Mile of Main. Smallest Amount Unaccounted-for per Mile of Main. Smallest Number Consumers per Mile of Main.				
Worcester County. (see Table F.)	107,360	30,235	9.6	10,690

* Indicates combination company.

	Pipe Laid, Feet.	Increase of Sales Over 1906, Per Cent.	Average Price Per 1,000 Sold. 1907.	1906.
TABLE F.—Companies Showing Largest Percentage of Increase.				
Worcester County ..... (see Tables E & H.)	81,207	95.30	1.79	1.69
Quincy (see Table H)....	89,707	71.47	1.47	2.00
Spencer*.....	187	41.95	1.39	1.51
Revere*.....	19,419	31.19	1.16	1.15
Chelsea* (see Table C)..	7,174	27.86	.991	1.08
TABLE G.—The only Companies Showing a Decrease.		Decrease		
Ipswich	3,034	25.92	1.78	1.69
Cottage City*		7.02	1.44	1.40
Adams*	2,939	2.23	1.33	1.28
TABLE H.—Companies which Laid the Most Pipe during the Year.				
Malden.....	116,623	20.31	1.01	1.12
Quincy (see Table F) ..	89,707	71.47	1.47	2.00
Boston*.	88,184	7.76	.798	.86
Worcester County..... (see Table F.)	81,207	95.30	1.79	1.69
Springfield.....	60,684	14.51	.951	.954
TABLE I.—The Largest of the 11 Companies which did not Lay any Pipe.				
Stoneham.....	....	7.71	1.93	1.96

TABLE J. Companies Showing the Largest Increase in Meters.	Total Number of Meters in Use 6-30-06.	Increase During the Year.
Boston* (see Tables A–D–H)	117,948	6,133
Lynn* (see Tables A–B–C).....	18,043	2,133
Malden (see Table H)	12,330	2,084
Springfield (see Table H)	16,456	1,633
Cambridge (see Tables A–B).....	21,545	1,557
Worcester (see Table D).....	16,674	1,508

* Indicates combination company.

during the year, two are to be found among those showing the greatest percentage of increase.

Worcester county made the poorest showing as regards sales and consumers per mile of main, but leads in the percentage of increase, and ranks fourth as to the amount of pipe laid.

All the oil gas companies showed an increase in sales, the percentages being 1.50, 7.31 and 12.69. Nine acetylene companies showed an increase in sales, ranging from 1.92 to 55.72 per cent., while three showed a decrease of 21.84, 22.26 and 43.86 per cent.

The number of consumers per mile of main, of both oil and acetylene companies, is very small, varying from 7.9 to 43.6. The total miles of mains laid amounted to approximately 211, the largest single amount being 21 miles.

Coal Gas.—Of 39 companies making coal gas, 36 carbonized more coal during 1907 than in the year previous. The first 5, as to amount, are as follows:

Lowell, 34,739; Cambridge, 34,686; Boston, 27,883; Worcester, 24,533; Springfield, 23,961.

Residuals.—The percentage of cost of coal received from residual products ranged, from 5.43 at Malden, to 72.31 at North Adams; the next in line being Lowell, 60.19; East Boston, 55.22; Charlestown, 54.63; and Gloucester, 52.98 per cent.

Address of the President (Mr. J. C. McDowell) of the Natural Gas Association of America.

Have modern inventions and discoveries added anything to the sum of human happiness? This question was propounded recently by a man with a young heart who remembered the old days before the railroad, the telegraph, the telephone, the trolley, the electric light, the skyscraper with its elevator, kerosene and natural gas, to a party of men at luncheon with him.

The discussion that followed was interesting and instructive, but there were only two modern things unanimously decided that materially added to the sum of human happiness. These were modern plumbing and natural gas. Approximately 75,000 householders have introduced it into their homes for the first time, since our last meeting, and it is now the only fuel used by about 7½ million people in the United States.

Gentlemen, I congratulate you on your connection with a business that daily adds to the happiness of over a million homes. The industry is comparatively new, having attained its present status in about 25 years. During that period natural gas has grown to be one of the great utilities of our country, but its importance in the industrial development of the country is realized by comparatively few, for its work is so unobtrusively done that it attracts no attention.

Prof. I. C. White, State Geologist of West Virginia, in his address before the conference of Governors, in Washington, last week, said in part: "It is not generally known that the tonnage originating in the Pittsburgh district, and passing through it, now exceeds that of four of the greatest seaport cities of the world—London, New York, Liverpool and Hamburg combined—so that not only Pennsylvania, but every State in the nation, is interested in perpetuating as long as possible this empire of industry which our wonderful natural resources and the genius of the American people have conquered." The Pittsburgh district undoubtedly owes its industrial supremacy to the impetus given to it and now largely maintained by natural gas. The iron masters of Pittsburgh were saying that the iron business must go to the lakes to meet the ore; when in 1884 and 1885 natural gas superseded coal in practically every industrial plant in Pittsburgh.

Puddling Furnaces.—In puddling furnaces 1 ton of muck bar required 40 bushels of coal, costing $2 per ton. Gas was supplied at $1 per ton. In addition to the saving in the net cost of fuel, there was also a large saving in repairs to furnaces and in handling coal and ashes.

Open Hearth Furnaces.—In open hearth furnaces the fuel cost of steel was reduced from $1 to 55 cents. The quantity per week was increased fully 25 per cent., and the quality improved over 1 per cent., and the life of the furnaces was prolonged. At the present time a ton of open hearth steel can be produced with 5,500 cubic feet of gas, and 9 melts can be made per week, as against 6 melts with coal. Open hearth furnaces using coal cannot successfully compete with natural gas at the present time.

Heating Furnaces.—From tests made in heating a 160-pound pile, the saving in wastage, in the use of gas over coal, is over 10 per cent. There is also a great saving in handling coal and ashes, and the life of the furnaces is greatly prolonged, while the output from each furnace is greatly increased. Equally good results were obtained in all lines of iron and steel manufacturing. Many iron and steel plants, by utilizing space otherwise required for handling coal, doubled their output.

For 6 years gas was supplied in Pittsburgh and vicinity at from ¼ to ⅓ the net cost of coal, and now industrial establishments multiplied. Lack of reasonably priced locations has been the only check to the growth of the section. In addition to the benefit to the iron and steel industry, gained by such use as fuel, the development of the natural gas industry furnished a new market for wrought iron and steel pipe. Prior to its use for natural gas lines, there was no wrought iron line pipe made larger than 6 inches in diameter—I laid the first 8-inch wrought iron, screw thread line pipe that was manufactured. And during the last 25 years the demands of the natural gas industry have furnished a market for about 1,000 miles per year of pipe; the sizes of 12, 16, 18 and 20 inches are now common, the total amount used in this period of 25 years approximating 25,000 miles of pipe, not to mention the fitting and appliances incidental to the laying of this pipe, and resulting in installing about 1 million meters, ½ million gas stoves, and appliances without number.

The Plate Glass Industry.—In 1883, when natural gas was first used in the manufacture of plate glass, there were two small factories in the United States, with an output of about 1 million square feet per year. Practically all our supply came from France, and its average price was over $2 per square foot. In that year, John Pitcairn induced Col. Ford to join him in the business, and the Pittsburgh Plate Glass Company built its Creighton plant in the Pittsburgh district; then followed Tarentum and Ford City, Charleroi and Walton, by the same people. Plants were also erected at Butler, Pa., at Elwood, Ind., and elsewhere, all using natural gas. The Pittsburgh Plate Glass Company has owned its own supply and lines from the first, and now consumes over 10 million cubic feet per day in the Pittsburgh district, and nearly as much at their Barberton (O.) works. Plants using coal cannot compete successfully with plants supplied with gas. The development of this industry can be directly credited to natural gas. The total yearly output of the plants in the United States is at present 40 million feet, and the selling price less than 30 cents per square foot. Only about 6 million feet are imported, and that in small sizes.

Window Glass.—In addition to the saving in fuel value resulting from cheap gas supplied to window glass factories throughout the gas belts of the United States, the saving in labor is greater in this industry than in any other. Its use enabled the American factory to successfully compete with imported goods, and has greatly improved the quality of the glass and increased the output of each pot. Practically all the factories are using gas, and have been known to pay 70 per cent. more for gas than its equivalent in coal—in addition to the great advantage to the manufacturer, the use of gas has cheapened the product to the consumer.

Fl nt Glass.—The use of gas greatly stimulated this branch of the glass industry, resulting in the keenest competition. Plants located in the gas belt, where gas is very cheap, are selling their product so low that factories not so favored are suffering. Our glass product is selling in London at a profit, at the same price for which it is sold here with freight added. The yearly output has grown from 80,000 tons, in 1890, to 290,000 tons, in 1907.

If time permitted, I could mention many other industries that owe much to natural gas. There is a widespread belief that natural gas is not now used to any extent in manufacturing in the Pittsburgh district. When the business of the district is in a normal condition, the average daily consumption for manufacturing purposes is about 210 million cubic feet, equal to 10,500 tons of the best Pittsburgh coal —nearly 600 carloads daily. If the supply of gas was shut off from the mills and factories of the district its business would be paralyzed. Many of its factories would be compelled to move, by reason of the lack of space, to handle the coal and the inadequacy of the present railroad facilities that are congested at times, handling the finished product.

The business in which you are engaged has not only brought happiness to a million homes, but it has been a great factor in this wonderful industrial development. Even in Ohio and Indiana, the region supplied by Trenton rock gas (that only lasted about 18 years), where, before the discovery of gas there was scattered throughout an agricultural community an occasional flouring mill, there are now scores of thriving industrial cities and villages, built up by cheap gas, but now using coal successfully.

President Roosevelt, in his address at the Conference of Governors, in Washington, last week, is reported to have said, "The enormous stores of mineral oil and gas are largely gone." The Government statistics show that in the year 1906 the production of oil and gas was greater than in any previous year, and the consumption of natural gas exceeded the year 1905 by over 12 per cent., its value being $46,873,932. The Government report for 1907 is not yet published, but it is believed by well-informed persons that the value of the product consumed in 1907 will exceed 50 million dollars, and the increased price alone does not account for the increased value.

New areas of gas deposits are being discovered, and deposits known to exist are being greatly enlarged from year to year. The great mid-continent field, at present the largest in area and most prolific in its yield ever discovered, is as yet only partially developed and the deposit scarcely touched. The gas deposits of West Virginia and Ohio (with the exception of the Trenton rock deposit), are not, as the President said, "Largely gone." On the contrary the producing areas of these States are being enlarged, from year to year, as the rock pressures of the old fields decline. Even Westmoreland county, Pa., from which gas has been taken in large quantities for 25 years, has renewed its vigor during the past year by the discovery of the Bayard sand (the very prolific sand of Greene county), within her boundaries, giving wells of big volume and a rock pressure of 1,200 pounds to the square inch. The gas producing sands of the Bradford region are now found in Butler and Armstrong counties, at a great depth, yielding good volume and a rock pressure of over 1,000 pounds.

Incipient areas are found in many sections of our country, from the Big Horn Valley, of Wyoming, to Alabama, many of them having the earmarks of large deposits.

Furthermore, in addition to known existing deposits brought to light, and more or less developed by the drill, it is well known that geological conditions favorable to oil and gas deposits exist, covering areas of vast extent, that have not been tested by the drill. I am highly in sympathy with the President's efforts to conserve our natural resources. The extravagant and wasteful use of natural gas is the open shame of our business, and our best efforts should be put forth to secure its economical use. In view of these facts, I consider the statement of the President, that natural gas is "largely gone," is reckless and unwarranted.

Having given close attention to the industry for the past 25 years, I believe that the business is yet in its infancy, and it is quite evident that I am not alone in this belief, for the investment of capital in the industry in the past 8 years exceeded the investment of all the preceding years, and the new investment of 1906 exceeded that of any previous year, and the total investment now closely approximates $200,000,000. It is doubtful if any other investment in this country of like magnitude shows better returns or less impairment of capital.

We have not yet learned all there is to know about the business; we are associated in this meeting for mutual improvement. The business has attained a dignity that demands our best efforts for its proper conduct; many errors of the early days still need correction.

I am pleased to meet so large a number at the first session. I am sure all who come in the attitude of students will be well repaid for the effort.

The Governing and the Regularity of Gas Engines.

Mr. James Atkinson (whose fame in the gas engine field is deservedly world-wide), in the course of a paper on this subject, read by him at the last meeting of the British Institution of Mechanical Engineers, had this to say on the subject named in the heading:

The continuous increase in the size of gas engines, and the widening field for their employment, have necessitated various modifications in their design and methods of operation, the question of their regularity of turning and closeness of governing being by no means the least important causes of these modifications. It is very usual to hear remarks made as to the irregularity of gas engines, as though they were usually and necessarily more irregular than steam engines, such remarks being very unfair. It is true that the cyclical variations of speed may be slightly greater in the ordinary single cylinder "Otto" gas engine than in the case of the ordinary steam engine; but the mean variation is usually considerably better, and, even with hit-and-miss governing, such engines are amply steady enough for ordinary shop-driving, pumping and the great majority of purposes for which power is required. Even for electric light driving, ample steadiness can be obtained by using a sufficiently heavy flywheel.

Methods of governing gas engines may be divided into two classes. In the first class the volume of the charge remains constant and sufficient to fill the cylinder as nearly as possible at atmospheric pressure, but the proportion of gas to air is varied according to the load. In the second the proportion of gas to air is kept approximately uniform, but the volume of the charge is varied either by closing the admission valve before the end of the suction stroke or by throttling; the result in either case being a charge sufficient to fill a part of the cylinder only at atmospheric pressure. The first method is commonly called the "quality" method, and the latter "quantity" method.

The most desirable arrangement to use depends to a large extent on the size and type of engine, also on the kind of gas employed. It is desirable to use the quality type with engines having any considerable weight of reciprocating parts attached to one connecting rod, because under these circumstances the inertia of the reciprocating parts should be cushioned by the compression pressure in the cylinder at the time of ignition, otherwise shock may be caused similar to that in a steam engine working with insufficient compression or load. Either the quality or quantity method is applicable to engines having only one piston attached to the one connecting rod and running at a moderate speed, as under these circumstances the reduced compression pressure is sufficient to take up the inertia forces and to prevent shock at the time of ignition. When some kinds of producer gas are used it is necessary to have governing appliances which are not liable to be upset by a little tar or dust in the gas.

The quality method may be subdivided into hit-and-miss governing, variable gas admission uniform during the suction stroke, and variable gas admission caused by opening the gas valve earlier or later during the suction stroke, but always closing it at the end of this stroke, the contents of the cylinder when reduced loads are being carried being to some extent stratified, air being next to the piston and a rich mixture drawn in last, remaining near the firing point.

The quantity method of governing may be divided into throttle governing and cut-off governing. With one or two unimportant exceptions all types of governing are included in the above.

For many years hit-and-miss governing was universally and exclusively employed, and it still remains the usual method for small or moderate sized engines. So far as the author is aware, its economy has practically never been excelled, being only equalled on full loads by very carefully arranged methods, and on light loads it is still

necessary to combine hit-and-miss governing with other methods to obtain such results.

As usually constructed the governor decides whether there is to be a hit and a miss by the fact of one knife-edge passing on one side or the other of a second knife-edge, practically by a hair line, and the same hair line on all loads; the governor itself, therefore, always governs when in one position, and it does not much matter if it is very far from being isochronous; also, as it has very little actual work to do, the parts to move being very light and there being scarcely any resistance to overcome, a very small governor will effectually control a large engine. The closeness of governing, or the mean variation of speed, on varying loads with an engine having a fairly heavy flywheel can easily be kept within 2 per cent. from full load to any load. Most gas engines fitted with hit-and-miss governing are arranged so that, if the engine pulls up on the load from any cause, the operating gear for opening the gas valve is drawn out of contact as the engine slows down and before it stops; thus the engine cannot stop with the gas valve open. This precaution is absolutely necessary for the safety of engines liable to be left for long periods by the attendant, and drawing their air charges from the engine room.

The ordinary hit-and-miss gear is well known, but a recent improvement may be described. It consists in allowing the blade of the pusher a small amount of sideplay at right angles to the line of thrust, so that the knife-edge may always find the bottom of the V in the die in whatever position the latter may be held in the governor rod. When disengaged, the blade rests in the V of the fixed block and naturally slides to the bottom thereof, thus returning to its proper position should it have been deflected sideways by the motion of the die. The deflections, without this improvement, though small, often cause corresponding movements of the governor, and occasionally nibbling or partial opening and sudden flying back of the gas valve, accompanied by needless wear-and-tear, objectionable noise, and sometimes irregular explosions in the cylinder.

There is a tendency in some quarters to belittle hit-and-miss governing, but for many purposes, especially in small engines, it still remains the most suitable arrangement, and it is advisable to give due weight to the solid and substantial advantages it offers before substituting other arrangements.

Quality-governing, by admitting the gas in varying quantities continuously throughout the suction stroke, is not generally adopted, though some very large engines have been controlled in this manner. The extent to which variation in richness of the mixture can be carried out in this way is somewhat limited. If the charge is either too rich or too weak, it will not ignite freely, but will burn slowly, and in either case a point is very soon reached when it burns so slowly as to continue still inflamed during the whole of the exhaust stroke, and until the commencement of the suction stroke, when the fresh charge drawn into the cylinder is fired by the smouldering flames still lingering there, and an explosion takes place whilst the admission valve is still open, resulting in burnt products being driven into the air and gas mains, sometimes causing the next or second charge to be vitiated, so that two full working strokes are occasionally spoiled in this way.

When the engine is always working on full or almost full load, this method of governing can be used successfully, but for engines which have to govern throughout the full range of work, from full load to no load, it is not satisfactory. It has, however, the advantage of simplicity. A very common arrangement is to have two throttle valves, one in the air main and one in the gas main, controlled by the governor which closes one as it opens the other, and *vice versa*. As these throttle valves can be arranged to be in equilibrium, the governor need not be very powerful. In small or medium sized engines the addition of a gas valve and hit-and-miss governing, to come into operation so as to miss occasionally when the engine is running below half load, make a great improvement to this type of governing, by preventing the irregularities which might otherwise occur on these light loads and also the excessive gas consumption. Unfortunately, hit-and-miss governing is scarcely suitable for large engines, owing to the inadvisability of opening a large and necessarily heavy gas valve by means of a knife-edge.

Variable gas admission, caused by opening the gas valve earlier or later during the suction stroke, but always closing at the end of this stroke, is a method of governing which is of recent years rapidly coming into use, and is a most satisfactory method, at any rate for large gas engines. By admitting the air and gas in this way, when working on light loads, air only is first drawn in, the gas being admitted towards the end of the suction stroke; the result is that part of the charge next to the piston does not contain any gas, or only a very small proportion, but the part near the ignition point has sufficient to make it freely ignitable, there being what is known as stratification throughout the cylinder during both the suction and the compression strokes. In the earlier days of gas engines, Mr. Frank Crossley perfected a method of applying this principle to the smaller engines made in those days by means of a stepped gas cam for opening the gas valve, the various steps causing the gas valve to be opened earlier or later, according to the power required, but always closing with the air.

A very considerable proportion of the large gas engines recently made have been governed in this manner, including all of the Oechelhäuser and the Körting types, in which it is practically necessarily adopted. Also a very large number of double cylinder engines, which unavoidably have considerable inertia in the reciprocating parts.

The author's firm having recently constructed some tandem engines of 500 to 600-horse power, the question as to the method of governing them had to be considered.

A novel type of governor was adopted, the arrangement of the gear being shown in Fig. 1. Referring to Fig. 1, main casting *A* is fixed on the top of the cylinder in which the valve proper is inserted. It has an air connection *B*, containing a throttle valve *C*, which is fixed definitely in one position to suit the gas which is being used, also a gas connection *D*, containing a gas cock *E*, which serves to regulate the gas. The admission valve *F* is opened at the commencement of each suction stroke by means of a cam rod and lever in the usual manner, being closed by a spring *G* at the end of the suction strokes. The gas valve *H* is centered on the spindle of the valve *F*, and has attached to it at its upper end a vacuum piston *I;* the admission of air, either freely, partially, or its non-admission to the vacuum cylinder, is controlled by a cylindrical plug *J*, having a groove turned in it which opens or closes the air connection. The position of this plug *J* is decided by the governor, a movement of about ¼ inch controlling the speed of the engine from full load to no load. Acting on the gas valve there is a nut *M*, which forces the vacuum piston *I* to the end of its upward stroke whenever the admission valve *F* is closed, being assisted finally by a strong buffer spring *L*. When the valve *F* is closed it will be seen that the spring *K* is neutralized; as soon as the valve *F* commences to open, the pressure of this spring at its upper end is taken by the nut *M*, which is screwed on the spindle of the valve *F*, and the pressure at the lower end tends to open the gas valve *H*. If the plug *J* allows free access of air to the vacuum cylinder, the gas valve *H* moves with the valve *K*, and also closes with it, allowing a uniformly rich charge to be drawn into the cylinder during the whole of the suction stroke, thus giving full power impulses. If, however, the plug *J* closes the communication from the atmosphere to the vacuum cylinder, the vacuum in the cylinder prevents the gas valve *H* being opened, a few pounds vacuum in this cylinder being amply sufficient to overcome the power exerted by the spring *K*. Under these circumstances no gas is admitted during the suction stroke, but as the air passage *B* is freely open, air only is drawn into the cylinder and there is no impulse; this represents two extremes, which in practice rarely occur, as the plug *J* is usually in such a position as to give more or less restricted admission of air, causing a partial vacuum in the vacuum cylinder at the commencement of each suction stroke, this partial vacuum restraining the opening of the gas valve, making it open later and more slowly; it, however, catches up to the main admission valve and always closes with it, consequently air only to a greater or less extent is drawn in first and a rich mixture at the last. There is a small snifting valve *N* opening outwards from the vacuum cylinder, which always insures the prompt return of the valve *F* in closing.

It will be seen that all the governor has to do, when governing a tandem engine having two single acting cylinders, is to move two small cylindrical plugs which are an easy sliding fit in their cylinders, the plugs themselves being always in equilibrium, with the result that prompt and certain control is always insured. The vacuum pistons, the springs, and the other moving parts are all inclosed and shut off from communication with the gas, consequently any tar or dust in the gas can only gain access to the gas valve, which is so constructed that its movement cannot be clogged; the mechanical parts are also constructed so that any wear will be infinitesimal. The actual operating medium is atmospheric air, which is costless and indestructible.

A short time ago an engine fitted with these valves was tested by Dr. Nicolson, Professor of Engineering at the Municipal School of Technology, Manchester.

The engine speed varied only from 119.4 to 121 4 revolutions per

minute when the horse power was instantaneously dropped from about 600 to about 50. The total variation in speed was, therefore, 1½ per cent. of the mean speed. The full load was then thrown on again as quickly as possible, and so on in succession. The speed of the engine under such circumstances never varied more than the above percentage. No back firing of any kind took place. A further advantage of this gear is that it is perfectly noiseless, with the exception of a slight hissing noise due to air entering and leaving the vacuum cylinders. The gas used was made from bituminous coal in a Crossley plant.

The gas was tested in a Junker calorimeter during the time of the test, the gas being taken from close to the inlet to the engine; the result was 149 B.T.U. per cubic foot on the lower scale, at atmospheric temperature and pressure, according very closely to the heat value given by the analysis. The engine was running on a brake load of 559-horse power, the gas consumption per brake horse power reduced to 0° C. and 760 mm. was 51.94 cubic feet per brake horse power hour. The heat supplied was, therefore, 8,128 B.T.U. per brake horse power hour. The thermal efficiency on the brake was, therefore, 31.32 per cent. (indicated horse power = 613.6; thermal efficiency on the indicated horse power = 35.6 per cent). So far as the author is aware, this is the highest efficiency that has been obtained in a large gas engine in any well authenticated trial.

Good governing is only one of the requirements in gas engines; when extreme regularity is necessary, more than one cylinder and heavy flywheels containing a considerable amount of inertia are also needed.

In designing gas engines to make them so that they will not exceed a definitely stated amount of irregularity, careful estimates have to be made as to the effect of the number and disposition of the cylinders, the power of the impulses, the inertia in the flywheel, the effect of the inertia of the reciprocating parts and of the compressions. A number of curves have been carefully prepared for the different arrangements in common use and under ordinary conditions. Some of these curves are shown in Fig. 2. The author is aware that somewhat similar

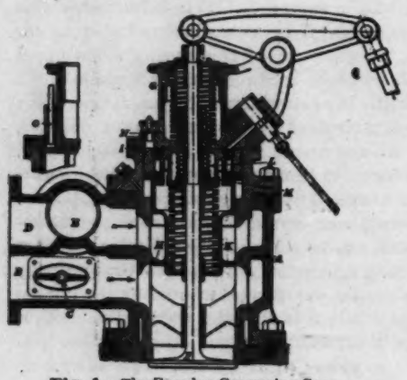


Fig. 1.—The Crossley Governing Gear.

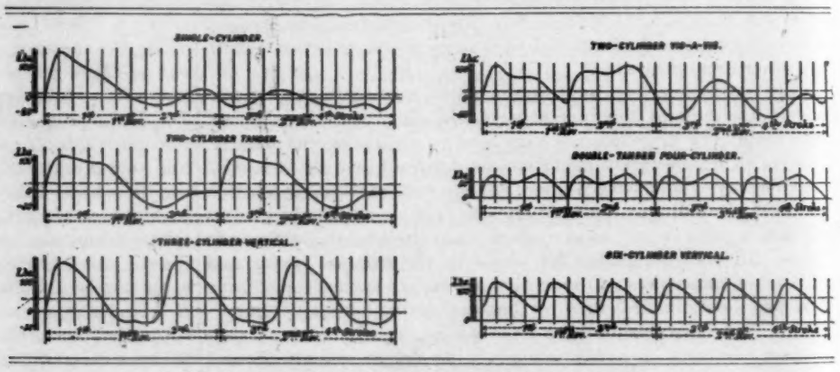


Fig. 2.—Tangential Turning Efforts on Gas Engine Crank Pins.

curves have been given in different publications, but not in a form in which they could be used conveniently.

The cylinders in all instances are assumed to be single acting, 18 inches in diameter and 2-foot stroke, and working with a mean pressure of 88.2 pounds. The compression pressure is 180 pounds and the mean pressure during compression is 37.2 pounds. The total force exerted during a working stroke in any cylinder is thus that corresponding to a mean pressure of 88.2 + 37.2 = 125.4 pounds per square inch of the piston.

The net power resulting from one impulse is:

$$\frac{88.2 \times 254.5 \times 2}{2{,}240} = 20.04 \text{ foot tons.}$$

For the purpose of enabling direct comparison between the various types of engines to be made, they are all assumed to be fitted with flywheels which have 30 impulses of kinetic energy in them when running at their mean speeds; that is to say, 20.04 × 30 = 601.2 foot tons.

1.	2.	3.	4.	5.
Single cylinder.....	1	106.3	1/49.9	1.8°
Vis-à-vis	1.29	138	1/38.5	2.33°
Tandem	0.836	88.6	1/59.7	0.75°
Double tandem	0.129	13.75	1/383.3	0.06°
Three cylinder.....	0.716	76.17	1/69.5	0.42°
Six cylinder.....	0.144	15.5	1/338.3	0.044°

The table above gives in column 1 the type of engine. Column 2 gives areas between the curves of turning efforts and the mean working lines from which the excess or the deficiency of work done can be estimated, these areas being given relatively to a single cylinder engine which is taken as 1. Column 3 gives the mean pressure per square inch on the piston throughout a working stroke which would give an amount of power corresponding to the excess or to the deficiency. Column 4 gives the speed variation expressed according to the formula $\frac{\text{Maximum} - \text{Minimum}}{\text{Mean}}$, assuming that the kinetic energy in the flywheel at mean speed is 30 impulses. Column 5 gives the difference in degrees the flywheel of the engine would be ahead of, or behind, a wheel of constant speed.

The particulars given in the table are obtained in the manner described below; the figures for the single cylinder engine being worked out, and those for the other types in a similar way. In the case of the single cylinder engine the area of curves above the mean power line during the first stroke, corresponds to a mean pressure of 67.67 pounds per square inch of piston referred to the full movement of the crank-pin for this working stroke and

$$\frac{67.67 \times 3.1416}{2} = 106.3.$$

Thus the excess of power in this engine having a cylinder 18 inches × 2 feet is

$$\frac{106.3 \times 254.5 \times 2}{2{,}240} = 24.15 \text{ foot tons,}$$

and this amount is added to the kinetic energy in the flywheel every impulse, accelerating its speed from its lowest to its highest speed. One-half the amount of 24.15 tons, or 12.075 foot tons added to or subtracted from the mean kinetic energy of 601.2 foot tons is 613.275 foot tons maximum and 589.125 foot tons minimum kinetic energy. The speed of the flywheel will vary in proportion to the square roots of these energies, or in the ratio of 24.764 to 24.273, the mean of these being 24.518, and the difference 0.491; the fraction

$$\frac{0.491}{24.518} = \frac{1}{49.95}$$

will represent the speed variation in this engine according to the formula

$$\frac{\text{Maximum} - \text{Minimum}}{\text{Mean}}.$$

Irregularities in speed cause the flywheel of the engine to get ahead of, or behind, absolute uniformity. In a single cylinder engine of the Otto type it passes from its most retarded position to its most advanced position and back again during the time the crank is making two revolutions and passing through 720°. Twice during this 720° the flywheel is moving at the speed corresponding to absolute regularity.

When gaining on, or losing this speed, it moves a mean of $\frac{1}{49.95 \times 2}$ times the mean speed of the flywheel, plus or minus this speed; consequently $\frac{720°}{49.95 \times 2 \times 2 \times 2}$ will give the total distance in degrees that the flywheel varies from uniformity, and half this will be the amount which the flywheel is ahead of or behind it. In this case

$$\frac{720°}{49.95 \times 2 \times 2 \times 2} = 1.8'$$

The figures for the other types of engines given in the table are ob-

tained by similar calculations; in the figures given in the fifth column, however, it is necessary to bear in mind that the 720° applies to the vis-à-vis type as well as the single cylinder engine, owing to the fact, as shown in its curve, that the acceleration continues during two consecutive strokes (the small area in between has to be deducted); in all the other instances the 720° requires also to be divided by the number of cylinders.

Speed variation is the important factor when considering gas engines as employed for most purposes, but for the special purpose of driving alternators in parallel, also for some other uses, speed variation is only one of the factors which have to be considered. It is necessary to combine it with a time element, and thus obtain the position variation—a point which is very frequently overlooked in this connection. It will be seen by comparing columns 4 and 5 that there is a very considerable difference in the relative variations of the different types of engines, and yet it is most unusual for anyone to ask for anything but speed variation when inquiring about an engine.

A notable feature emphasized by the table is the excellent result which can be obtained by a double tandem, single acting cylinder engine; that is to say, one having 4 single acting cylinders operating on to 2 cranks.

A New Method to Obtain Sulphate of Ammonia.

[Prepared for the JOURNAL, by MR. FREDERIC EGNER.]

In the course of a lecture delivered by Herr A. Peters, of Cologne, Germany, at a recent meeting of the Association of Gas, Electricity and Water Business Men of the Rhine Country and Wesphalia, an interesting description of a method to obtain, by direct process, in the shape of sulphate, the ammonia evolved in the operation of coke ovens was given, of which the following is an abstract that should be of interest to American gas makers. The apparatus described consists in the order named, first, of a "heat exchange," as Mr. Peters calls it. This appears to be a large cylindrical vessel constructed for all the world like a gas tube hydraulic condenser, but in which the tubes are much larger (though the writer can see no reason why they should not be of ordinary dimensions) than in the apparatus as we know it. Next there are two multitubular water cooled condensers of the common type, connected in series; then, the exhauster, following which is a tar extractor. The next apparatus in order is a saturator, connected to which are a centrifugal and acid chamber and an ejector. A still, milk-of-lime mixer and pump, a small ammonia liquor tank, a separator and a tar tank complete the apparatus. The connections and course of gas are as follows:

The crude gas from the retorts is conducted to the top of the "heat exchange," passes downward through the tubes, then through the condensers, which are arranged so that the gas will pass up on the inlet, and down on the outlet side of each. Then passing through the exhauster, it is forced through the tar separator, from which it returns to the "heat exchange," where it passes through the section of the apparatus that in an ordinary multitubular, water cooled condenser would be occupied by the water. The gas enters at the bottom of said compartment and out at the top, then passes on into the bottom (through a dippipe) of the saturator, where, bubbling up through the acid solution, the ammonia is removed, forming sulphate, which settles to the bottom of this vessel and is lifted, by means of the ejector, into the centrifugal. The mother liquor from the centrifugal flows back into the saturator by means of a suitable connection. The acid supply to the saturator is continuous, consequently the strength of the solution is always the same, while the upper zone being a little stronger, absorption of all ammonia is assured, and in fact none escapes.

The object of reheating the gas, after it has been freed from most of the tar and moisture, is because, required by the point of condensation, the saturated, water vapor loaded gas must be superheated to the extent that, when passing through the acid bath, these vapors will not condense therein, and so weaken the solution in the saturator. The dewpoint with retort gas is about 70° C., and with coke oven gas at about 80° C., because coals used at gas works are usually of a better quality and do not contain as much moisture as those used generally at coking works. Practical experience has demonstrated that the degree of superheating need not exceed 80° C. before entering the saturator. Within these boundaries (70° and 80° C.) the formation of the sulphate actually takes place, whereas in the normal method the temperatures must be kept above 100° to prevent any condensation of the water vapors coming through the ammonia still. By reduction of the temperatures as described there is greater security of the binding of the sulphuric acid and ammonia in the form of the salt; since the lower the temperature the greater is the affinity of the acid and alkali. The greater the temperature the lower the affinity, for at 140° C. sulphate will melt, and is decomposed at temperatures below 140° C. The writer believes that he has described the course of the gas through the apparatus with sufficient clearness to enable "those skilled in the art"—as our U. S. Patent specifications usually express it—to construct the apparatus for themselves; and a little thought ought to make clear to the practical man the importance, *to gas works of any dimensions*, of this method of ridding coal gas from ammonia; for not only will the quantity of water required in the "scrubbing" operation be enormously reduced or practically "wiped out," but from a cost view it becomes in a measure a profitable operation, since a valuable by-product is recovered in the shape of sulphate of ammonia in a way which even the smallest gas works can adopt, that under no circumstance previously could save the ammonia, owing to the liquor resulting in the old way of scrubbing, naturally being so weak, that saving it was out of the question. More might be said, but the writer trusts that the intelligent reader can now successfully solve the matter, and see the "point" without further argument.

In the connections of the apparatus described suitable drain pipes are provided, by means of which any condensation not treated, such as the hydraulic main liquor and drain from condensers, tar extractor and "heat exchange," are conducted to the separating tank, from which the tar flows to the tar well, the ammoniacal liquor going into the liquor tank, from which it is pumped and treated through the still already mentioned. But, since the bulk of the ammonia is recovered from the gas directly as described, these latter vessels need not be as bulky - the tar well, of course, excepted—as with present methods.

Mr. Peters gives the assurance that the light giving constituents, the hydrocarbons, are in no wise affected by this process of removing ammonia, stating that the apparatus has been proved and practically demonstrated up to a daily capacity of 3,531,000 cubic feet of gas. In a summary of the advantages of this new method, Mr. Peters mentions the following: First, the costly ammoniacal liquor tanks are eliminated and the mass of waste water is reduced to the mere results of condensation. Second, the cost of apparatus is much reduced by reason of the absence of the usual scrubbers and ammonia and cyanide and naphthaline washers. Besides, the constant expense for pumping the scrubbing liquids, or turning of scrubbers by means of engines, is entirely done away with; and there is a saving of room and reduction in cost of plant in general. To the writer it seems Mr. Peters deserves more than "thanks" for his disinterested, valuable and practical suggestions, from which, and upon which, the preceding lines are taken and based. Operators of small or medium sized works especially are recommended to give these suggestions more than a passing thought. Wideawake men need no urging in a matter which promises such valuable results.

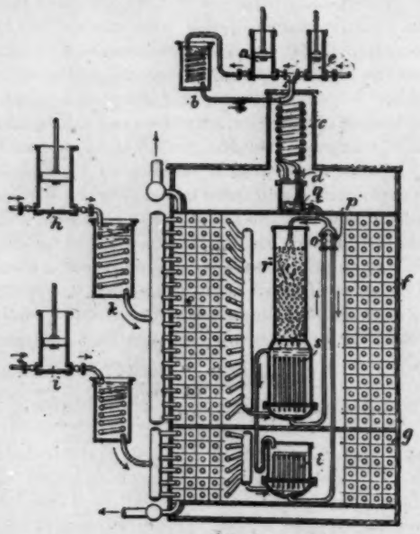
The Separation of Oxygen from Liquid Air.

Engineering (London) notes that the modern methods of producing liquid air, devised about 1894 by Dr. Hampson and Prof. Linde (Royal College, England), led to the thought that, by a fractional distillation of this product, oxygen would be readily obtained in large quantities and at a very cheap rate. When liquid air is allowed to evaporate, the nitrogen, being the more volatile constituent, distils off more rapidly than the oxygen, and the residual liquid becomes continuously richer and richer in the latter element. When 60 per cent. of the original volume of liquid air has evaporated the residue contains about 50 per cent. of oxygen, whilst if 95 per cent. of the liquid is allowed to evaporate the remainder contains about 88 per cent. of oxygen. For some purposes oxygen is not needed in a specially pure state. A very powerful explosive can, for instance, be made by soaking cotton-wool in liquid air containing but 40 per cent. to 45 per cent. of oxygen, but in general, where the gas is needed for commercial purposes, a somewhat high degree of purity is required—a not uncommon standard being 98 per cent. pure. The original method of preparing oxygen by the fractional distillation of air proved too expensive when the product was required to have so high a standard of purity as this, and it was natural, therefore, for inventors to attempt to apply to the problem some of the methods which had proved so successful in cheapening the distillation of alcohol, in particular the process known as rectification.

In this country the rectification of alcohol is usually effected in the

so-called Coffey still. In this apparatus the wash, containing but a small percentage of alcohol, is exposed in a series of shallow trays, placed one above the other, to the action of steam. This steam partially condenses in the trays, the heat liberated in the act driving off some of the alcohol contained in the wash, which passes over with the remainder of the steam into a condenser, which consists of a series of chambers separated from each other by perforated plates. The condenser is of the surface type, the circulating water being replaced by the cold wash on its way to the evaporating chambers. This cold wash enters at the top of the condenser, whilst the vapors from the evaporating chambers enter the lowermost chamber of the condenser, and flow up through each chamber in succession. In the first, or hottest, chamber, the alcoholic vapor or condensed spirit contains a large proportion of water. As, however, these vapors pass up into the cooler chambers above, the steam bit-by-bit condenses, liberating alcohol from the liquid in that chamber, and the enriched vapors pass on to the chamber above, where the percentage of alcohol is again increased by a repetition of the process just described. By this continuous enrichment it results that very pure alcohol only reaches the upper chambers, from which it is continuously withdrawn. Owing to the adoption of an interchanging process, by which the same quantity of heat is used, so-to-speak, again and again, the Coffey still is very economical of fuel.

It has not proved possible to adapt, without change, the methods adopted in distilling alcohol to the rectification of liquid air. In fact, the difficulties at one time appeared so great that no less an authority than M. Raoul Pictet declared, at the end of the year 1899, that such a process of rectification would be *sans valeur et desastreux*. Nevertheless, these difficulties were surmounted by Prof. Linde in 1902, and a little later by M. Claude, who, though apparently working independently, devised a procedure which, in a patent action just decided in the Appeal Court, has been held to embody the essential features of Professor Linde's apparatus. The latter is shown diagrammatically in the illustration. Here the pumps *a* and *e* and



the coils *b* and *c* form part of the ordinary Linde plant for producing liquid air. This, when formed, collects in the vessel *q*, and from that can be passed as required into the rectifier *r* below. This liquefying plant has only to make good relatively small, but unavoidable, losses of cold, the actual process of rectification being of a regenerative character. The rectifying column *r* is filled with glass marbles, resting on a perforated tray at the top of the chamber *s*.

The vapor of liquid oxygen from *s* tends to rise through the rectifying column, but meets in its path a descending stream of liquid air, obtained in part from the liquefying apparatus already mentioned, and, in part, from two interchangers, to be presently described. The liquid air meeting in its descent the warmer vapor of oxygen, condenses the latter, an equivalent quantity of liquid nitrogen being evaporated instead. Hence the vapors passing up through the glass marbles become continuously poorer and poorer in oxygen, and at the top of the rectifying column are practically pure nitrogen, which is then drawn off through an interchanger. The descending liquid, on the other hand, becomes as it falls richer and richer in oxygen, and finally enters the chamber *s* as practically pure liquid oxygen. From the top of this chamber liquid oxygen falls through an overflow pipe into a lower chamber *t*. From the top of this chamber gaseous oxygen is drawn off through an interchanger for collection and storage.

The interchanger, in which the top of the rectifying column is connected, is shown at *f*. The gas passes out through a long spiral chamber, down the center of which is a tube, through which air is forced at a moderate pressure by the compressing plant indicated at *h* and *k*. The incoming air meets the outgoing nitrogen, with the result that when the nitrogen finally escapes it is at a temperature not much below the normal, whilst the ingoing compressed air is progressively cooled until, when it reaches the base of the vessel *s*, it is not much above the temperature of liquefaction. The chamber *s* is, it will be seen, divided into two by a tube plate, from which extend upwards a series of Field tubes into the liquid oxygen above. The incoming air enters these tubes, and being at a considerable pressure, condenses to a liquid which passes up the rising main *o*, and expands through a valve down to atmospheric pressure. In this expansion a portion, mainly nitrogen, of the liquid evaporates, and the remainder falls on the top of the rectifying column *r*, as already explained.

There is, it will be seen, a second compressor *i* and a second interchanger *g*, the latter being connected to the top of the vessel *t*. From the top of this the oxygen required is drawn off, as already explained. The gas is evaporated by the heat given up by the compressed air passing through the inner tube of the interchanger to the bottom of the vessel *t*, which is, it will be seen, of similar construction to *s*. The air condensed in the Field tubes passes up to the top of the rectifier by the second rising main *p*.

The process is, it will be seen, a very ingenious adaptation of the well-known Coffey still to the separation of oxygen in a high degree of purity from liquid air. Owing to the regenerative process adopted, the loss of cold is small, and the "make-up feed," which is supplied by the air-liquefying apparatus, shown to the top of our figure, is moderate in quantity.

Shop Arrangement.

The following is from a paper read by Mr. H. F. Baillet at this month's convention of the New Jersey State Association of Master Plumbers:

Being one of your State officers is of considerable advantage, as it brings a man not only in contact with so many of his fellow crafts men, thus enabling him to learn and absorb valuable information, but it brings him also into the shops of members throughout the State and enables him to see how others have their shops arranged and to cull out the best things that the others have in the way of shop arrangement. It would be the acme of selfishness for one to take in all these good things and not give anything in return, so it is my intention to try to tell you some of the good things I have seen in the shops of the members and to call your attention to some of our mutual mistakes.

Of course, surrounding circumstances greatly aid or hamper each of us in our shop arrangements. Rental values (and the men or firms who own their own buildings are circumscribed by the rental values thereof the same as those who rent) and comparative business situation of our shops govern to a great extent opportunity for advantageous shop arrangement. Then, again, every man has little or large peculiarities of temperament, and nowhere does this crop up more than in his shop arrangements. For all of these reasons it were folly to attempt a description of anything approaching what might be termed a model shop. In fact, we might run up against the same proposition as did the model man. Not many miles away there lives a man who is a confirmed pessimist. One day his good wife, trying to get him into a livable humor, said to him: "Well, Dick, no matter what happens, you are at least a model husband." This rather chirped him up a bit, until it occurred to him to look into the dictionary, where he found the word model defined as a small imitation of the real thing. When he became more pessimistic than ever. So if I attempted to outline to you a model shop we would probably all land in the dumps. There are, however, several broad lines that we all can follow to our mutual advantage.

Shop Must be Adapted to a Variety of Work.—We must first take into consideration that 9 out of every 10 shops are more or less—and generally rather more than less—jobbing shops. To this we must add the fact that in New Jersey generally we combine tin and sheet iron work, also steam fitting, with the plumbing business. Now take an ordinary average business of this character that has been estab

lished, say, 8 or 10 years, and you will find on its walls probably some 800 different kinds of articles of stock and some 150 different kinds or pieces of tools. Of course, some get along with considerably less and some have considerably more, but the figures given will be about the average. Now it is a plain proposition that this material and these tools should be so housed that they can be got at quickly. The cost of unnecessary duplication of tools and material or the loss of time hunting for the things runs into many dollars with all of us even under the best shop arrangements, and with many of us it turns what might be a profit into a positive loss.

Junk and Dark Holes.—One of the main obstacles to orderly shop arrangement is the presence of junk, and by junk I mean not only old metals, but dead material of all kinds. Everything for which you have not a reasonably continual use is more or less junk, and everything of this kind it is cheaper to throw away than it is to keep. The biggest shop in the State is none too large for an orderly, systematic arrangement, and when we consider that the average business does not afford the rental value of more than sufficient room for our most pressing needs, it is the height of foolishness to save up a lot of what is practically junk in the expectation that it will come in somewhere some time or other. Better sell it off for junk and treat yourself and the good wife to a theater party than to have it laying around for years, continually moving it about from one corner to the other, paying out more in spot cash for wages handling the stuff than we could replace it for several times over should we find the time come when we want to use it. We are all of us more or less dealers in junk. Then let us act like sensible dealers would and turn it into money, or, if that is not possible, at least not spend any more money in handling, but throw it out.

Having got rid of our junk, let us next get rid of the holes. By holes I mean the many dark corners where we shove things to get them out of the way. It is surprising how much money lies around in the corners of most every shop. It will pay us to clean out every corner and board it up. Every cubby hole that is not in plain sight and the goods in which are not profitably moved within a reasonable time is practically a hole in your pocket. "Sew it up."

Good Light Worth Money in a Shop.—This brings us to the subject of light. Wherever it is possible to get your light from the sky, do so. Skylights are by far the best means of lighting a shop. And not alone do you obtain better light, but you gain the wall space, which otherwise would be taken up by windows, for bins and racks, and of these you cannot have too many. A good friend of mine recently built himself a new shop. He wanted plenty of light so he had more than half of his wall space windows, and found that he was obliged to put his fitting bins down cellar. Another place I know has no windows at all, but two generous skylights with practically half the glass exposure of the other man's windows, giving more and better light, while there is plenty of room for twice the number of fitting bins that the first mentioned has, and it is not necessary to grope around a semi-dark cellar for anything.

Special Arrangement for Fitting Bins.—In speaking of fitting bins there is in no one thing of a greater diversity than in this particular convenience, both as to location and arrangement. There can be no question as to the advisability of a sufficient number to house all goods of their kind separately so far as possible. As a usual thing this matter is most especially a matter of development. The beginner will stick up a few bins in the handiest place. As the goods accumulate he finds it necessary to put up a few more bins in the next handiest place, and so we will usually find bins stuck in all conceivable corners of the shop, fittings, trimmings and parts more or less jumbled together. It is no uncommon thing if you should go into a shop for a fitting to have the help say, "I will look for it." If it is not in one place, they will say, "Wait a minute, perhaps it's in the other bin." Now if it is necessary to spend 40 cents' worth of time to ascertain if a 10-cent fitting is in stock it becomes manifestly cheaper to buy another than to look. And this is usually done. The consequence is an accumulation of stock that does not move, but keeps piling up unnecessarily. In other words, lying idle, goods becoming broken, parts becoming separated, fittings going out of date and the place being glutted with junk. In every case a loss of money. I have in mind a place that is so arranged that a new journeyman or helper can learn where to find most anything in short order. Fortunately space was available.

Different Fittings Classified and Separated.—First, steam goods and fittings, soil pipe and fittings and water pipe and fittings are in entirely different parts of the shop. Then the arrangement of the bins is unusual. Instead of starting out with the largest size fittings and having the bins run on in rotation, the fitting bins are arranged in sections. The center section contains the most used sizes, and this section again is laid out so that of this the most used stock is directly at from waist to eye height from the floor. Standing in the center of the wall space the eye first sees and the hand reaches ⅜, ½ and ¾-inch fittings, ells and tees. Here again straight ells and tees are all at the extreme left, reducing fittings following, street ells, crossovers and similar odd fittings being either in a straight line to the right or on a line vertically from the initial fitting. The upper part of this section, working from left to right and from the top down, contains 1-inch and reducing fittings. The next section toward the right contains 1¼, 1½ and 2-inch fittings, and the last section contains in the upper half pipe straps, fasteners and miscellaneous appliances, while the lower half contains bushings, caps, plugs, etc., from 1 inch upward. The sections to the left of center contain in upper part brass fittings and in lower part fittings below ⅜ inch; also all unions are in one row, bushings from ¾ inch down in rotation.

A Guide Card.—A card is handy, one glance at which tells where to look. The central idea is that the medium size most used things are in the center, larger to the right and smaller to the left. The lower tiers below waist line are given up to nipples, and here again ⅜, ½, ¾ and 1 inch, the most used sizes, are in the center, larger on the right, smaller on the left; upper half, galvanized; lower half, black. The scheme can be varied, of course, to suit conditions. The advantage is that the underlying idea is applicable to different conditions. The underlying idea evidently is to have all fittings for one branch of work together, having the different branches separated, and having in each branch the most used or medium sizes in the most accessible and easiest seen part, the larger adjoining in one direction, the smaller in another, with least often used stock on what might be called the outskirts.

Care of Brass Goods.—We find usually a great difference in location of brass goods. The haphazard way of using any unoccupied space that may present itself has its adherents. Also the arrangement of keeping them under lock and key. Where there is office or store help we frequently find the brass goods in that part of the establishment which is constantly under the eye of whoever is in charge of the store or office, and those getting out these goods are required to have them charged in the office.

Make Attractive the Office, Store and Shop.—The comparative importance of store and office *vs.* shop proper also shows much differenae of opinion in arrangement. A plumbing, tin or pipe fitting shop proper is not exactly "a thing of beauty and a joy forever." It is more apt to be a dirty, greasy place, full of smells and other things. "Old *passèe*" water closets, with broken horns, dilapidated seats with half a hinge, or parts of hydrants and closet valves, floats, levers and battered sprinkling cans are not attractive to the customer. If real estate conditions and the chancellor of the exchequer allow, have a large store fitted with up-to-date fixtures. If not, have an office, but don't rob yourself of shop room, of storage room, of working room, for the sake of throwing a big front with your office. Neither should we expect our customers to come into the shop to transact their business. Have as nice a front as your business will permit. Let it be ever so small, but let it be nice. A desk set into a workshop will do in a pinch, but it is just as much out of place as a bull in a china shop.

Storage Space Gained by Mezzanine Floors.—A little wrinkle I saw a while ago and copied with great advantage is a mezzanine floor. Where the ceiling is 12 or more feet high a hanging floor on one or more sides of the wall will provide considerable additional floor space, in many cases enabling one to have practically two rooms in one, with the accessibility of one large room and the subdivision of two.

Storing Short Pieces of Pipe.—Most all shops accumulate quantities of short pieces of pipe, which is generally piled up in one corner, to be sorted over every time a man wants a certain length piece, with the result that when the boss is not looking he will cut a length sooner than look the pile over, with the result of further accumulation of still more pieces. A neat wrinkle in one shop was a bin with slanting sides, starting with 1 foot width on top and coming out 3 or 4 feet at bottom. This was divided vertically for sizes of pipe and horizontally for lengths of pieces. In putting pieces away a man could not put the piece in the wrong compartment, because it would be too long or too short, the length being governed by the depth of the bin, and in wanting a piece of any certain length it was very readily found. The cost of this arrangement was merely some rough boards and perhaps at most a day's time. The saving in wastage and time every year is considerable.

Portable Shop Conveniences.—Collapsible work tables, pipe benches, etc., are all items of shop arrangement that save rent and make for compact stowage and saving of space. Of course the main thing in all shop arrangement is order. Order and system save your time, money and temper. It saves doctors' bills and vitality.

Care of Pipe Threading Dies.—Some time ago, when attending a master plumbers' meeting, two of the brethren were discussing the advisability of having pipe dies recut. A third remarked that such a question never troubled him as pipe dies were usually lost, strayed or stolen before they had a chance to get dull. In another shop the loss of pipe dies is reduced to a minimum. Each set of stocks and dies is kept in a sheet iron box, and no separate dies are allowed to be taken on a job. The journeyman is obliged to take out a complete set in a box, and is held responsible for the return of that set. One set of small and large stocks is kept at the shop vise with dies. These sets are not allowed to be taken out.

Check System for Tools.—Another employer has a tool closet in his office, in which are shelves and hooks for shop tools. Pipe wrenches from 18 to 48-inch, drills, sledges and the large number of shop tools have their place. When the occasion for their use arises a ticket is hung up for any tool taken out. This ticket contains the name of the journeyman taking the tool out and the date, and the journeyman must see that he obtains that ticket when the tool is returned to the office, otherwise it is charged to him. A glance in at the open door shows what tools are in and if out where they are at.

System Contributes to Success.—Some time ago when in company with a bunch of craftsmen, as sometimes happens, they were discussing the success of an absentee. The remark was made that he had a finely appointed shop. One young member replied, "Yes, and I'd have the same if I was as successful as John is. If I had his money." A little inquiry brought out the fact that John had started with no more than the average master plumber, but had from the first been noted for his neatness and his pride in his business environments, always making improvements and keeping his place up to the mark. The question came to me very forcibly: Has John a finely appointed place because he is successful? Or is he not rather successful because of his systematic and orderly shop and business arrangements? It's worth thinking over.

By-Product Coke and the Foundry Trade.

In the report of the address on "By-Product Coke," delivered before the Pittsburgh Foundrymen's Association, June 1, by Charles E. Pope, of the Coal and Coke By-Products Company, Pittsburgh, he began with a description of the character of coal deposits and turned to the use of the beehive oven in wood and charcoal burning and its adoption in the present manufacture of coke. He said the beehive type of oven accomplished only one purpose, which is the coking of coal, as it burns all the gas, tar, ammonia, besides 20 per cent. of the coal over the Rothberg. This is a closed oven, heated by means of horizontal flues between the coking chambers in which the coke can be charged loose or stamped, thus coking the coal and preserving all the valuable by-products, the coke being controlled in quality and manufactured on a scientific basis to answer the foundrymen's requirements. The retort oven, in his opinion, is the oven of the present and future and the beehive that of the past. He claimed that, although opposed by about 90 per cent. of the coke manufacturers, the by-product oven is coming into use, on account of its saving and its being able to produce a suitable coke for the foundry from a lower grade of coal than the beehive oven. The output of by-product coke is steadily increasing and it is only a question of time until, on account of it superior quality, it will lead.

Mr. Pope referred to the recent meeting called by President Roosevelt for the purpose of discussing the protection of our natural resources, coal being one of the matters that received attention. Coal is being burned up shamefully every year, its valuable by-products are wasted in millions of dollars, and it is necessary that we economize and get the benefit of this waste. He stated that some foundrymen are opposed to the use of by-product coke on account of its black appearance, but that this did not affect the quality of the coke. This black appearance is caused by its being quenched on the outside of the oven, while the coke with the silvery appearance, quenched inside the oven, would have the black appearance were it treated as the former. Foundrymen are ahead of blast furnace operators in using by-product coke in greater tonnages, they having investigated the matter and ascertained that it would answer their requirements by being hard, dense, burning quickly and fiercely, and its carrying the burden of pig iron, besides enabling them to specify and receive the grade they require.

He made a suggestion to the effect that the firms represented, the Association as a body or the American Foundrymen's Association erect their own by-product coking ovens. They would thereby effect great savings in the by products and get their coke when they wanted it and in the quantities and grades desired. This in turn would greatly benefit their casting business by, first, bringing up the average profits and, second, increasing their trade to the extent of supplying castings to new by-product coke companies that are sure to come in the near future. He estimated such requirements on the basis of 1,000 tons of castings for each 500 tons output per day of by-product plants erected.

The Use of Flame and Other Arc Lamps for Exterior Illumination in England.

By Prof. E. W. Marchant, D.Sc., in *The Illuminating Engineer.*

As a comparatively small number of results of test made on the modern flame arc lamps have been published, the figures obtained in some fairly complete trials on these lamps, with a view to determining their suitability for street illumination, may be of interest. These tests were carried out with a view to determining the actual gain in efficiency obtained by using a modern yellow or white flame carbon arc lamp in place of one of the older pattern lamps. The first point of distinction between a flame lamp with inclined carbons and the ordinary arc is the light distribution. In the ordinary vertical carbon arc the maximum illumination occurs at an angle of from 40° to 60° below the horizontal, the exact angle for maximum illumination depending on the length of arc used. In the inclined carbon lamp the maximum intensity of illumination is in a direction vertically underneath the arc. Curves obtained for two typical lamps are shown in Fig. 1, A and B.

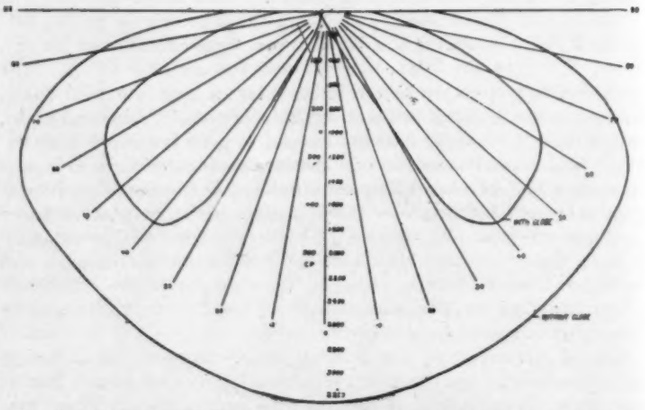


Fig. 1A.—Flame Lamp Yellow Light. Average Volts — 38, Current — 10 Amperes. Mean Hemispherical Candle Power — 2,650 (without Globe). " " " " — 390 (with Globe).

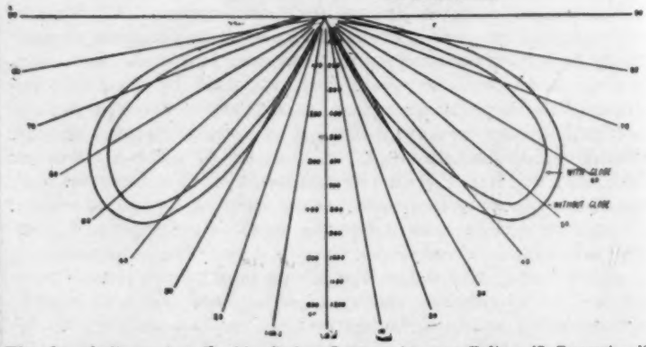


Fig. 1B.—Ordinary Arc Double Carbon Lamp. Average Volts — 47, Current — 10 Amperes. Mean Hemispherical Candle Power — 745 (without Globe).

This alteration in distribution of light is a disadvantage for exterior illumination, since it gives maximum effect immediately below the lamp, *i. e.*, on the ground which lies nearest to the source of light, with the result that the surface illumination obtained with such lamps is patchy, being very bright directly under the lamp, and rapidly falling off the farther one goes from it. Although in

most of these lamps when the globes are in position the vertical light is almost entirely cut off, there is still a tendency for the illumination to reach its maximum at an angle considerably nearer to the vertical than with the older type of lamp. It may be of interest to compare the illumination curves given with one which has been drawn—Fig. 2—to show the candle power curve that would be required to give uniform horizontal illumination over a limited area.

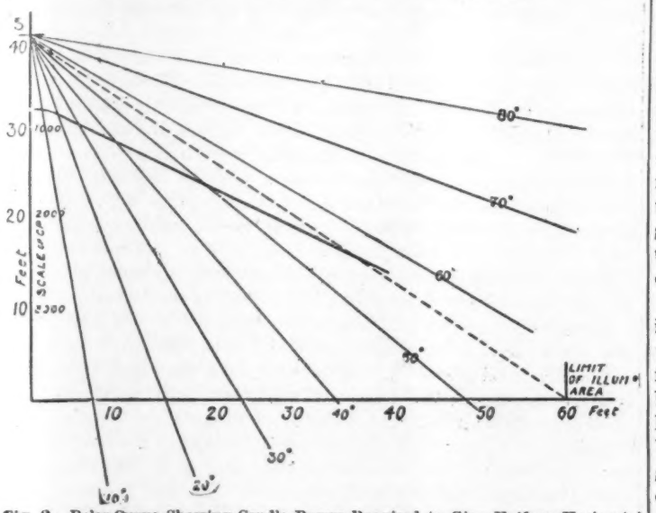


Fig. 2.—Polar Curve Showing Candle Power Required to Give Uniform Horizontal Illumination of 5-Candle Foot over a Limited Area from a Single Source (S).

The illumination curve has been drawn so that the source of light gives 0.5-candle foot horizontal illumination over an area 60 feet in radius, with the lamps supported 40 feet above the ground at the center. This curve approximates much more closely to the illumination curve given by an ordinary arc lamp than to that given by the flame arc lamp with inclined carbons, and shows clearly that a lamp with vertical carbons is much more suitable for street illumination.

The increase of efficiency with the flame lamps is well known, but some of the figures obtained may be of interest. For the sake of comparison, the mean hemispherical candle power has been determined, although the magnitude of the mean hemispherical candle power is far from being an adequate criterion of the suitability of a lamp for general illumination.

	Mean Hemispherical Candle Power.	Watts Per M.H.S.C.P.
Yellow flame lamp	2,650	.144
White flame lamp.....	1,270	.338
Ordinary arc..... ..	620	.69

These measurements were made without globes, the arc taking a current of 10 amperes at a pressure of about 45 volts in each case.

These figures are comparative, the actual values of the candle power in the flame lamps vary within wide limits for a given lamp, according to the quality of the carbons employed. Some of the flame lamps tested, however, burnt with remarkable steadiness, particularly those giving a yellow flame; in this respect they are not at all inferior to the older ordinary carbon lamps.

Besides testing these lamps without globes, a number of observations were made with the globes in position. The "globe" tests are liable to a certain amount of inaccuracy, since, with a globe, the source of light becomes scattered, and the square law by which the candle power was estimated does not hold, except at great distances from the lamp. With the globes used on the flame lamps the light was usually reduced to about one-sixth of its former value, though in some cases the absorption of the globe was even greater, the light emerging being only one-tenth of that actually produced by the lamp. Making a corresponding comparison with globes in position, the figures are:

	Mean Hemispherical Candle Power.	Watts Per M.H.S.C.P.
Yellow flame lamp.....	360	1.05
White flame lamp.....	200	2.15
Ordinary arc.....	190	2.25

It will be seen that the flame lamps under these conditions are very little better than ordinary arc lamps, and have hardly as high an efficiency as some of the modern metallic filament glow lamps.

It may at first sight appear remarkable that the makers of flame lamps should use globes which practically neutralize the gain in candle power obtained by using the flame arc. These globes, however, are very brilliant and conspicuous objects when the lamp is burning, and where a lamp is used (as it is in many cases) for spectacular purposes the brilliance of the globe becomes of practical utility. At the same time where illumination is wanted it is obvious that a comparatively clear globe should be used. For street lighting, where the lamps are placed high and well out of the direct line of vision of a person in the street, a slightly obscured or even a clear globe might well be employed. If the lamps are low the glare from an arc in a clear globe is, of course, very dazzling, and a dense globe becomes a necessity. Under most conditions it is clearly of no advantage for the electrical engineer to attempt by every means in his power to give, let us say, 10 per cent. more light for a given supply of energy to his arc lamps, when the illuminating engineer absorbs 90 per cent. of the total that is produced in the globe.

A point of some importance in connection with street illumination is the color of the light used. It is a well-known fact that, on the whole, a reddish colored light has far greater penetrating power in a fog than one of a white color. This point may be very clearly seen by a casual observer noticing the distance at which yellow flame lamps and ordinary arc lamps remain visible in foggy weather. Yellow lamps are visible at a distinctly greater distance than those giving a white light. It is exceedingly difficult to get any actual comparisons between the penetrability of different colored lights on account of the variations that are liable to occur from time to time in the amount of light that a lamp gives, but there can be no doubt of the greater effectiveness of the yellow flame lamps burning under these conditions. This point is one which deserves further consideration from illuminating engineers. In some rough tests made in Liverpool it appeared that the effective illuminating power of a yellow flame lamp in a fairly dense fog was about 30 per cent. greater than that of a white light lamp burning under similar conditions.

It is to be hoped that flame lamps will lead to the more extended use of electric light for street illumination; many lamps of this kind have already been erected. Unfortunately, in lamps intended for street illumination, in which it is essential that the time of burning without retrimming shall be as long as possible, very little care appears to have been taken to avoid losses by absorption, due to auxiliary appliances inside the globe. Lamps of this description are now fairly common, and many of them are of great ingenuity in design, and are admirably constructed; but it cannot be too strongly urged that the essential quality of a lamp is to produce as much light for a given expenditure of energy as possible, and though long burning is of equal (possibly of even greater) importance than efficiency, care should be taken that long burning is not obtained at too great a cost.

The development of the flame lamp has been most remarkable, and the operation of these lamps reflects great credit on those who have been responsible for their development; the modern flame arc, when compared with the unsteady flame arc used in the laboratory 10 or more years ago shows a wonderful advance, but the limit of efficiency is very far from being reached, and it is to be hoped that lamps of this type will continue to progress until they hold an indisputable position as the most efficient means of illumination that we have.

[Concluded from Page 1024.]

A Review of the Present Practice and Economies of Timber Preservation.

[A paper prepared for, and read by PROF. EUGENE P. SCHOCH, at the Fourth Annual Meeting, Southwestern Gas and Electrical Association.]

The germicidal power of high boiling tar oils has scarce been stressed enough so far. The quantity of oils which will dissolve in water, it is true, is exceedingly small, hence the amount of the oil used up in the course of time is practically negligible; yet that small amount renders the water absolutely germicidal to a degree only attained by a comparatively large concentration of zinc or mercury salts.

We have, then, as the first important property of preservatives,

their germicidal power; next comes their lasting power. Reference has already been made to the fact that portions of creosote, such as the tar acids, carbolic acid, naphthaline, and in general all oils boiling below 270°, are either so readily volatilized, or are so readily dissolved in water, that they gradually disappear from the wood, hence it is primarily the high boiling oils which give creosote its value as a wood preserver, because, besides being highly germicidal, they are quite permanent. Zinc and mercury salts have their greatest defect in their solubility, on account of which they are readily washed out of the wood, particularly in wet localities.

Besides the preservative substances above discussed there are on the market many of what may be called proprietary wood preservers. As far as I know, none of them contains ingredients essentially different from those mentioned above. Of course, several of these substances may be variously combined. Depending upon the quality and the relative amounts of the ingredients, these proprietary wood preservers may or may not be worth their price.

Although the ultimate test of any wood preservative is the practical result it produces, yet chemical analyses properly interpreted by experienced parties, in my opinion, may be justly relied upon to judge the value of an article approximately. Hence, I would advise parties who contemplate the purchase of a wood preserver to ascertain the composition of the substance, then judge its value with reference to the points discussed above, namely, its germicidal value, and its power to resist atmospheric influences, considering in connection the amounts to be injected per cubic foot or per square foot surface. It might be pointed out here that a wood preserver should not form an outer coating, but should soak into the outer layers of the timber. The statements made with reference to the efficacy of the four classes of substances previously discussed may serve as a basis for judging the value of the proprietary composition. Much valuable advice may be obtained in this connection from the United States Forest Service. The value of a certain brand lies mainly in the assurance it gives of furnishing uniformly the article it claims to furnish, and, if everything else is favorable, this assurance has a considerable market value. To illustrate, one of the best known brands of witch hazel on the market is sold under a proprietary name, and though it is absolutely nothing but a pure essence of witch hazel and is known to be such by everybody, yet it commands steadily a higher price in the market and has a greater sale, because the firm has maintained the quality of this product uniformly the same and the public have found that they could rely upon it.

It is unfortunate that the life of timber in its natural state and as treated by different preservatives cannot be definitely given, because so many factors enter into the determination of its life. There is, first of all, the kind of wood, then the season in which it is cut, the extent of seasoning or drying, and all the other special points which have been called the "idiosyncracies" of timber. Above all, the local climatic conditions determine the life of timber, so that it becomes almost impossible to make definite statements regarding the life of untreated timber, or of timber treated with different preservatives. However, if we bar unusually favorable or unfavorable local climatic conditions, and remember that individual pieces of timber may show results differing considerably from the averages, then the following few statements based on a large number of observations may be ventured. Life of white oak and cedar ties, untreated, 10 years; inferior woods, such as tamarack, loblolly pine, etc., 4 to 5 years. Inferior wood ties, treated, as follows: Burnettizing, 12 years; creosoting, very light treatment, about 4 to 5 pounds per cubic foot, 16 years; 12 pounds creosoting, 20 years; 18 or more pounds creosote, 25 to 30 years. In addition, the following found by the railroads of the United States may be considered as particularly reliable: Pine ties treated with zinc chloride, east of the Mississippi, 10½ years, west of the Mississippi, 11½ years; treated with creosote, even with light treatment, the life is greater than with zinc chloride. Reference has already been made to the fact that wood tar distillates and crude oil used in moderate quantities have not increased the life of timber to a satisfactory degree.

Considering next the quantity of preservative used and the cost of the operation, I may offer the following general averages obtained in the operation of the large "pressure" plants and as actual cost conditions to which a reasonable amount of profit must be added before a commercial price can be arrived at. Cost of Burnettizing, 5 cents per cubic foot, or 15 cents per tie of 3 cubic feet. Cost of Wellhouse, zinc tannin process, 6 cents per cubic foot, or 18 cents per tie. Cost of the zinc chloride-creosote process, 9 cents per cubic foot, or 27 cents per tie. Creosoting, light treatment, enough for 16 years' life, 10 cents per cubic foot, or 30 cents per tie; 12 pounds creosote, 18 cents per cubic foot, or 55 cents per tie; heavy treatment, enough for 30 years, 28 cents per cubic foot, or 85 cents per tie. The operating cost of large pressure plants is from 5 to 8 cents per cubic foot of timber. The efficiency of the pressure treatment, using a sufficient quantity of good creosote, is beyond question and needs no further comment. In some cases, for instance, piles for marine exposure, nothing else will answer. It appears to be the conclusion of the railroads that pressure treatment is the most efficient. Doubtless this is partly due to the fact that they own and operate their own plants and operate on a large scale. The high price of creosote leads the railroads to try zinc chloride extensively. The substance is comparatively readily washed out of the wood, so that its use in moist regions is inadvisable. In dry regions it appeared to be serviceable, particularly because the ties are destroyed by wear-and-tear in about 10 years, and zinc chloride is able to prevent decay for this length of time. Since the introduction of tie plates and of the Reuping process, which uses only small quantities of creosote, the tendency is to abandon zinc chloride treatment. I should add here that the use of zinc chloride for poles gives little promise of success because the salt is so readily washed out.

Parties buying treated timber are confronted with the same difficulties in a sense that they are confronted with buying a commercial brand of a wood preserver. In the first place, the word "treated" is entirely too vague; the details of treatment must be specified. In good pressure treatment, the following amounts are injected: Zinc chloride, from ¼ pound to 1 pound per cubic foot of timber; creosote, from 5 to 15 pounds per cubic foot, the latter is the maximum that should be asked for for land exposure. The zinc-creosote process treats, first, with 12 pounds of 2 per cent. zinc chloride solution per cubic foot, then allows the timber to dry for 10 days, and subsequently injects 3 pounds of creosote per cubic foot. With the stipulation of the amount of injection should go the specification for the kind of creosote. The railroads have come to the conclusion that it is profitable to use the best creosote only. Their standard specification for coal tar creosote runs as follows:

Specific gravity at 38° C.—1.03.
No distillate below 200° C.
Up to 210°—not more than 5 per cent.
Up to 235°—not more than 25 per cent.
Residue beyond 355, if it exceeds 5 per cent. in quantity, it must be soft.

Purchasers should insist on being furnished with the statement of the tests on the creosote with which the wood is said to be treated. But even with all the specific statements as to quantity and quality of the creosote which has been injected, fraud is possible and has been practiced. Professor Alleman, of the United States Forest Service, states that of 12 specimens cut from a consignment of piling guaranteed to contain 16 pounds of oil to the cubic foot of timber, some contained less than 3 pounds and none over 7 pounds. The writer, in examining many samples of creosote in the market, has met some samples which would be little better than crude oil or wood tar distillates; they are nothing but low boiling oils with tar dissolved or suspended in them. The purchaser should take sample borings from the shipment and have them analyzed by a competent chemist to determine the quantity and quality of the creosote or zinc present.

The open-tank method for the treatment of timber, which was developed recently by the United States Forest Service, has so far not been in practical use, hence it is difficult to say whether or not it will be economically efficient. We pass, then, to the consideration of wood preserving by so-called superficial application. These methods are usually not considered by the large users of wood which can use pressure treatment, because at first sight they seem to give little hope for success. Yet, the unprejudiced observer must admit that the proper substances "superficially" applied add greatly to the life of timber. During former years, when less was known about the causes of decay, absolute penetration was thought positively necessary to preserve the wood. Since absolute penetration was not always attainable, and the inner, untreated portions of the wood remained intact, the views as to the necessity of complete penetration were gradually abandoned. The treatments, particularly with creosote on account of its high price, became lighter and lighter. Yet, under these conditions, very few instances of absolute failure of creosote preserving have been cited. The penetration attained with pressure differs only in degree from that attainable without pressure. The question how little penetration will prove economically successful has not been experimented upon sufficiently to give a definite

answer. Referring to the explanation for the mode of action of the preservative given above, it appears necessary that the treated layer of wood be so thick that any moisture passing into the wood during wet seasons may take up enough of the germicide to inhibit the growth of fungi. Naturally, the thickness of this layer should bear some proportion to the thickness of the timber. All things being equal, the deeper the penetration, the greater would be the protection. If the timber checks to a great extent, openings may be made into the untreated portions and decay may enter there. This, of course, may happen even with creosoted timber. In this connection it may be mentioned that, whenever creosoted timbers have to be cut so that untreated surfaces are exposed, the workmen are directed to paint these with creosote, a procedure which all users of creosoted timber have found very beneficial. A preservative which is placed close to the outer surface of the wood is exposed more rigorously to wind and water, hence must withstand solution or evaporation to a remarkable extent. Thus material for superficial application will probably be more expensive; but the lesser cost of the application may counterbalance the additional cost. This procedure of superficial application has been in use for many years, but not until very recently have comparative tests been instituted to determine the comparative efficiency of different materials applied by dipping and brushing.[1] Hence we are not able to say anything with reference to the *comparative* economic value of superficial treatments and deep penetration treatments. I cannot refrain from referring again to the fact that either of these properly done differs only in degree from each other. On page 11, U. S. Forest Service Circular 111, we find the statement: "For small individual operators who cannot afford the cost of a large plant, brush treatments are feasible and economical." A few figures of cost for labor for superficial application may not be out of place here. From figures obtained by the United States Forest Service, it is seen that the cost of painting the butts of poles for the length of 6 feet with as much of the preservative as the wood would absorb with 2 coats, the cost per pole is about 8 cents for labor.[2] Cedar, chestnut and arbor vita poles during this treatment will take up about 2½ to 3 pounds of tar oils per pole for 20 square feet surface. Ties may be dipped into a preservative liquid and allowed to remain there for a sufficient length of time to absorb from 2 to 6 pounds per tie at a cost of 3 to 5 cents per tie for labor.

Returning now to the question, "Does it pay," I feel that I cannot do better than to quote two estimates furnished by the Forest Service, adding, however, that the estimates are exceedingly conservative, and could safely be made much more striking. A hemlock tie as furnished and laid in the track cost 75 cents. Its treatment in the railroad's own plant cost 12 cents. Using the formula:

$$r = R\frac{(1.0p)^n X\ 0.0p}{(1.0p)^n - 1}$$

in which r is the annual charge, R the initial expenditure, p the rate of interest, and n the years of the recurring period, we find that the annual charge on the untreated tie with the assumed life of 5 years, and interest at 4 per cent., give us

$$r = 75\frac{(1.04)^5 X\ 0.04}{(1.04)^5 X - 1} 16.8 \text{ cents.}$$

For the treated tie, if it lasts only 1 year additional, the annual charge is 16.6 cents. This shows that the added life of a single year pays for the cost of treatment. Since zinc chloride treatment adds 5 years at least to the life of the tie, and since the annual charge for 10 years' time is 10.7 cents, we see that the treatment secures even a *saving* of 36.3 per cent. on the annual charge. The following is quoted from United States Forest Service Circular 136, page 20:

Assuming the life of an untreated pole to be 12 years, it cost $9 set in the line, the rate of interest on the investment at 6 per cent., and the cost of the carbolineum brush treatment 45 cents, it is found that the treatment will have to add about 1 year to the life of the pole to pay for itself. The Forest Service considers that the treatment will add at least 3 years to the life of the pole. Even with these figures, which are high for the quantity and cost of material used, and extremely low for the added life, the treatment makes 200 per cent. profit on its cost.

In conclusion, I may safely say that the question, "Does it pay?" has received such a positively affirmative answer, that the real question confronting every timber user is: "Which treatment is the most economical?" This is a problem that every man must figure out for himself as given in the preceding examples. It is safe to say that future market conditions will add largely to the calculated profit.

1. See U. S. Forest Service Circulars, 104, 111 and 136, and "Year Book," Dept. Agriculture, 1905, p. 455.

2. See U. S. Forest Service Circular, 134, p. 18.

Destiny's Tricks in Oil.

The "Petroleum Gazette" for June remarks that 42 years ago occurred an event which was of considerable consequence to this community at that time and was a matter of importance and interest to the people of Clark and adjoining counties, and is also a matter of history in the development of the Clark county oil field. The incident referred to was the dedication of the Oil City House on Parker Prairie, 5 miles north of town, which was made the occasion of a grand dedication ball on May 9, 1866, in which many of the most prominent citizens of this part of the State participated.

The Oil City House, which was built for the oil boom that was launched on Parker Prairie at that time, still stands and does duty for the present oil business. It is situated on the Kimball Young farm, and is occupied by C. C. Green.

The oil fever at that time was at a high pitch and a well was drilled for the company that was formed to promote the field by P. D. Judson, and land in the vicinity of Oil City brought fabulous prices, some tracts being sold for $1,000 an acre.

The oil boom of the sixties, however, was doomed to disappoint promoters; the tools were lost in the well and other mishaps occurred, causing a failure to produce oil in paying quantity.

Although the venture was a financial failure, evidences were found at that time in the way of some oil and abundance of gas that proved to many that a pool of oil existed here, and led to another futile effort to unearth it in the eighties, when a Mr. Patten drilled a well near the first one.

Curiously enough do the vagaries of fortune, fate, destiny, or whatsoever it might be called, figure in contrasts and sequels in the oil business. Prolific pools are almost opened, as in the above case, when by some event, or series of events, the aspects are entirely changed and the regions are crossed and re-crossed as condemned territory by operators passing to and fro between producing points of other localities.

As to individual leases the instances have been hundreds in number, in the various fields throughout the country, in which territory classed as condemned has served to confound if not to annoy the previous holders thereof by turning out to be very profitable stuff for later possessors. On the other hand, it has often happened that the initial tests have proved the most prolific ones and have lured the later investors into the expenditure of much unavailing confidence and cash. The deepest well is shallow compared with the thickness of the earth and the diameter of the hole made by the largest drilling bit is small as compared with the earth's surface.

Nobody knows it all in the oil business. Behold, frequently, the successful and so-called practical operator, in the exercise of that spirit of generosity which prompts him to assist in lifting any weight of extra cash from the shoulders of a fellow man, selling to a greenhorn property which it is expected will never burden him with any of the responsibilities of wealth. Behold, further, the said greenhorn drilling a little deeper or locating in a very nest of dry holes, and striking it rich.

Again, the tenderfoot in the oil business, but successful in other spheres of activity, will invest some of his surplus funds in what has been known to be a good oil property, whereupon or presently the wells will dry up or their output will be superseded by a flood of salt water. For a time—and sometimes a long time—one hopeful prospector will drill nothing but dry holes, while some other operator, seemingly no more shrewd, and working in territory no more inviting, will be rewarded with good wells. Again, the conditions will be reversed; the one will get the good ones while the other scores the dusters, and it not infrequently happens that each, in his successful periods, finds good fortune where the other missed it.

Very peculiarly, indeed, as regards the oil business, do the twisty trails of hope deferred and the rocky roads of failure converge into and deflect from the popularly objective avenue known as Easy Street. It is certain that nobody can strike good wells where what should be the producing formations are barren or do not exist, and it is equally certain that the more practical methods applied in any business the better the average of the returns; but, conceding this, it must be admitted that the producing branch of the oil business, or the vocation

of finding petroleum, is one in which there enters prominently the element of luck or chance.

A fact referred to before is worth repeating here: It is now nearly 49 years since Col. E. L. Drake drilled his famous well on the flats southeast of Titusville, and yet if before that well was drilled he had sunk all the other thousands of wells which have been drilled in the regions since then, he would not have found oil in any of them at the same shallow depth as in the original well, though shallower wells of surface drainage and buried leakage have been found and briefly operated.

To a considerable degree the experience of Illinois, as above referred to, has been the experience also of Texas, Kansas, Oklahoma, California and some of the principal Eastern fields. In the case of each of them their value for oil and gas came very near being demonstrated by pioneer wells many years before the final opening of these fields.

The extent to which this experience may apply to other regions, as shown in the developments of the future, is a matter which only the developments themselves can definitely determine, all prophesies and prospectuses to the contrary notwithstanding.

The Production of Coal in 1907.

Virtually complete returns to and compiled by Edward W. Parker, statistician in charge of the division of mineral resources, United States Geological Survey, show that the production of coal in the United States for 1907 not only far exceeded any previous record, but also exceeded by a considerable amount all estimates of the output for that year.

The aggregate production of anthracite and bituminous coal in 1907 amounted to 480,450,042 net tons, valued at $614,831,549, against 414,157,278 net tons, valued at $513,079,809 in 1906. The increase in production in 1907 over 1906 was 66,292,764 net tons, or 16.01 per cent. in quantity, and $101,751,740, or 19.83 per cent. in value.

Of this large production in 1907, 76,432,421 gross tons, or 85,604,312 net tons, were anthracite coal from Pennsylvania. In 1906 the production of Pennsylvania anthracite was 63,645,010 gross tons, or 71,282,411 net tons, valued at $131,917,694, so that the increase in the production of hard coal in 1907 amounted to 12,787,411 gross tons, or 14,321,901 net tons, with an increase in value of $31,666,362.

The total production of bituminous coal in 1906 was 394,845,730 net tons, valued at $451,247,493, an increase over 1905 (when the production amounted to 342,874,867 net tons) of 51,970,863 net tons, or 15.16 per cent. The value of the bituminous production increased from $381,162,115 in 1906, to $451,247,493 in 1907, a gain of $70,085,378, or 18.39 per cent.

Of the 31 States in which coal was produced during 1907, there were only two in which the output in 1907 was less than that of 1906. These were both unimportant producing States—California and Oregon—and in both the decrease in production in 1907 was due to the increased production and use of oil for railroad and manufacturing purposes. Nearly all of the coal mined in Oregon is sent to San Francisco, and the increase in the output of California oil has materially reduced the production of coal in Oregon.

Had it not been for the depressed condition of the iron and steel trade, which followed the financial depression of October, 1907, the coal production for the year would undoubtedly have exceeded a total of 500,000,000 tons, and the value would probably have exceeded $650,000,000. As it was, the value of the coal product of 1907 exceeded by 68 per cent. the value of the total mineral product of the United States in 1880, and was nearly equal to the value of the entire mineral product of the United States in 1897, only 10 years before.

The average price for bituminous coal at the mines in 1907 was $1.14, against $1.11 in 1906 and $1.06 in 1905. The average price in 1907 was higher than that in any other recent year except 1903, when prices were abnormally high because of the famine produced by the great anthracite strike in 1902. The average value of the anthracite produced in 1907, taking into consideration the quantity of coal used at the mines in the operation of properties, was $2.14 per gross ton, as against $2.05 in 1906.

Excluding the quantity of coal used in the operation of the mines, which is designated as "colliery consumption" and which has been in the past considered an unmarketable product, the value at the mines of the anthracite coal produced in 1907 was $2.39 per gross ton, against $2.30 in 1906.

Items of Interest
FROM VARIOUS LOCALITIES.

MR. H. LAKAMP, who who assistant to Mr. John Franklin (the resignation of the latter was reported in the JOURNAL last week) has been appointed Superintendent of Distribution to the Union Gas and Electric Company, Cincinnati.

MR. IRA A. MILLER, Superintendent of the Colorado Springs (Col.) Gas Company, has been elected Secretary of the Cottonwood Coal Company, a corporation recently formed, in Colorado Springs, to operate an important coal property that adjoins the mines of the Pikes Peak Fuel Company. The Company is capitalized in $750,000.

A COMBINATION of the interests of the Long Beach and the Inner Harbor Gas Companies, both doing business in Long Beach, Cal., has been effected. The combined concern is to be known as the Long Beach Inner Harbor Gas Company. Its capital is $500,000, and its officers are: President, Thad. Low; Vice-President, F. W. Stearns; Secretary, W. H. Marshall.

MR. C. S. W. PACKARD, President of the Savannah (Ga.) Gas Company, has notified the holders that, under the sinking fund provisions of the Company's mortgage, sealed offers will be received, until 3 P.M. of the 30th inst., at the office of the Pennsylvania Company for Insurance on Lives and Granting Annuities (Trustee), for the sale to it at the lowest price, not exceeding 105 and accrued interest, of as many bonds as $19,253.53 will purchase. The offices of Mr. Packard are in the premises, 517 Chestnut street, Philadelphia.

MR. HOWARD F. MCCONNELL has been elected Manager and Treasurer of Eglinton, Hammond & Andrews, of this city, whose specialty is dealing in gas and electric securities.

MAYOR GRINSTEAD, of Louisville, will soon have to name the Commissioner that w ill take part on behalf of the city in naming the rate for gas that may be charged there during the period of 5 years, from October 1, 1908. Under the charter the rate is fixed once in 5 years, by a board of 3 Commissioners, all of whom shall be civil engineers. The Mayor appoints 1, subject to confirmation by the City Council, the Company appoints 1, and the 2 others appointed select a third.

MR. JOHN S. BARTLETT, for several years Vice-President of the Lynn (Mass.) Gas and Electric Company, has been elected its President, vice the late Mr. Charles H. Newhall. Mr. Eugene B. Fraser, the Company's Treasurer, has been elected to the vacancy on the Board of Directors, and to his duties as General Manager Mr. Charles F. Prichard will add those of Vice-President.

THE injunction proceedings to restrain Mr. Avery C. Sickles from active direction of the affairs of the Berwick (Pa.) Gas Company have been estopped through the dissolution of the preliminary order obtained.

THE tests of the gas meters used for the measuring of quantities supplied to the public buildings of Toronto are not averaging as the sensationalists wish. For instance, these meters were examined in one day and were found slow in the percentages given: Ald. E. N. Armour, 103 Averne Road, 4.06; Cowan Avenue Fire Hall, 3.38; Ossington Avenue Fire Hall, 1.62; Ald. J. J. Graham, 1.23. Further, one of the meters passed gas, but did not register it.

COUNCILMAN HENRY E. WOODBERRY, evidently believing that the Committee named by the Council (Woodberry was of the Committee) to confer with the Beverly Gas and Electric Company with a view to securing lower rates for gas and electricity, was moving too slowly in the premises, is proposing to appeal direct to the Board of Gas and Electric Light Commissioners. In fact, he is now circulating a petition to that end, and in it he asks for these ridiculously low figures: Gas, $1.10 per 1,000 cubic feet; electricity, 10 cents per 1,000 watts.

HERE is something concerning the municipally owned gas plant of Middleboro, Mass., which came to us by way of Boston, under date of the 15th inst.: "At the adjourned town meeting, held in Middleboro last week, it was reported by the investigating committee that had

been looking over the electric and gas plants with a view to selling them, or rehabilitating them, that sufficient funds could not be obtained to carry out the latter plan. This again brings the matter of selling the establishment up to the voters. The plants are in a tottering state, although to date they have cost the taxpayers considerably over $100,000."

THE authorities of Clinton, Mass., are also said to be still anxious to secure control of the local gas and electric lighting systems. If they do, however, Clinton's residents will regret it in the long run. Mention of Clinton further recalls the fact, and regrettable fact it is, that those in control of its lighting systems seem so little disposed towards putting a fair sum in extensions.

AT a hearing held some time ago, or towards the close of the second week in June, on the petition of Messrs. Nevins and Ford, of Haverhill, Mass., for the right to supply gas to the towns of Abington, Rockland and Whitman, Mass., the matter was taken under advisement. This means that the authorities have virtually decided to accept the terms. The hearing was brought off in Abington, and a goodly number of property owners and merchants discussed the appeal. Mr. Nevins, who is the wideawake Manager of the Haverhill Gas Company, said that the petitioners had ample funds to go on with the project, even if, as it was said, it would require an expenditure of $250,000 or more. The residents could, if they so wished, subscribe up to 45 per cent. of the capital required, but any per cent. on their part was not a requisite. The main thing at the moment was to obtain the requisite franchise, which, if granted now, would enable the projectors to take advantage of the lull in the business of the apparatus supplying concerns. It would take perhaps a year to build the plant and equip the houses of the consumer, and he was sure the people wanted gas, and would be perfectly willing to pay the low rate ($1 per 1,000) at which it was proposed to sell it. Not one present spoke against the petition; to the contrary, many of the most influential citizens of Abington and Rockland heartily favored it. Although we catalogued Mr. Ford as from Haverhill, in reality he is a prominent financier of Scranton, Pa., whose connections stand ready to back him in any reasonable or necessary sum in this enterprise.

THE authorities of Kenosha, Wis., are now satisfied that the gas meters kept in service by the Kenosha Gas and Electric Company are not of the fast order. Several of the measurers (84 we believe) had been examined up to the 11th inst. by the State inspectors—all on complaint of consumers were those 86—and the average error over all was 2.92 slow.

WE understand there is no truth whatever in the report that the authorities of Portland, Me., are considering the taking over by purchase, for operation on public account, of the plants of the Portland Gas Light Company.

MANAGER MYLER, after much hard and active work, has succeeded in restoring the gas supply to Oak Cliff, which is across the Trinity river bottoms that separates it from Dallas, Tex. During the great tidal rise last May the mains were submerged, and remained so for several days.

MAYOR WISE has vetoed the ordinance under which it was proposed to issue a franchise for the operation of the Clatsop (Ore.) Fuel Company, which was formed for the purpose of supplying gas for lighting and fuel purposes in and around the place named. His main objection to the grant was the selling figure named—viz., $1.50 per 1,000 cubic feet.

"W. B. M.," writing under date of the 15th inst., incloses the following: "Over 100 members of the Office Men's Association of the Denver (Col.) Gas and Electric Company listened, the evening of the 9th inst., to an interesting address, by Judge E. C. Stimson, at their first annual banquet at the Adams Hotel. The spread was arranged to mark the success of the School that has been conducted in the interests of the Association during the past year. Lectures by the most noted educators of the State on all subjects that would be helpful to young men employed in a large corporation have been given weekly during the year, and the School has proved so popular that the Company has made it an established institution. Judge Stimson said he disagreed with those who maintain that the man in the ranks of a big corporation is only a small cog in the machinery, and that the success of the many men who have gone out from the Denver Gas and Electric Company to high salaried positons is sufficient refutation to such an assertion. The banquet in every material point of view was successful, and much of such success was due to the nice sense of order and direction characteristic of the School's President, Mr. J. M. Mulvihill."

THE Massillon (O.) Electric and Gas Company has recorded a mortgage on all its belongings to the New York Trust Company in the sum of $500,000. The sum would seem to be ample for its avowed purpose, "To meet the expenses of acquiring, improving and extending its mains and other appliances."

WE understand that the proprietors of the Chicopee (Mass.) Gas Light Company have arranged for the laying of a leading main from the Springfield boundary line to their plant on Depot street. The connection is run to enable the Chicopee Company to stop manufacturing and to obtain its supply from the Springfield corporation.

THE Cincinnati (O.) *Post* says that, on the 11th inst., after a meeting of the Executive Committee of the Union Gas and Electric Company, of that city, notice was served on the employees of the New Business Department of the gas division of the Company, that on July 1st their services would be dispensed with.

IT has been decided to put in an up-to-date water gas plant in Beaver Dam, Wis., to replace the gasoline gas plant that was destroyed by an explosion last March. A site has been purchased and the tentative plans call for a plant equal to putting out 125,000 cubic feet per day.

MR. GEORGE WEHRLE, of the Clarksville (Tenn.) Gas Company, writing under date of the 15th inst., says: "If you will kindly permit me the space I would like to tell the readers of the JOURNAL about a strange prank of lightning that came to my notice here. It certainly seemed a most unusual occurrence. A 2-inch service pipe supplying a residence here runs for a length of 1,500 feet through a grove of trees, from the street to the house. A few days ago, during a severe electrical storm, the lightning struck one of these trees. Running down the trunk to the ground, the current took a zigzag course, which could be plainly traced along the withered grass, to a point directly over the gas pipe, perhaps 50 feet away from the tree, where the bolt or bolts went into the ground, making two perfectly round holes, about 1¼ inches in diameter. From the surface to the pipe it followed the latter to the house, a distance of 300 feet, and then set fire to a leak at the meter, which leak must have existed prior to the storm. Fortunately, being early in the evening, the fire was speedily discovered and extinguished without any damage having been done. This only tends further to prove how dangerous a gas leak, of any volume, small or large, is, and how strangely it may become ignited. I think an insulating joint would have stopped this particular bolt of lightning, for I believe it would have run around it."

MR. A. D. HARLAN, one of the original projectors of the plan to construct a gas worke in Coatesville, Pa., died at his home in Wenonah, N. J., the morning of the 11th inst. He was in his 75th year, having been born in Marlborough, N. J., September 3, 1833.

THE percentage of operating expenses to gross income, as returned by the Brooklyn Union Gas Company for the year ended December 31, 1907, is a trifle over 63. For the same period the sum charged to depreciation was $946,551. The total net income for the period was $2,428,739.

"T. R. V.," writing from Scranton, Pa., under date of the 16th inst., incloses the following: "A very enjoyable and completely informal dinner, was tendered the newspaper men of that city and its office employees by the Scranton Gas and Water Company, the affair being given in the Wyoming street salesrooms of the Company. In effect, the dinner was an excellent practical demonstration of a few of the many things that can be done in the cooking line with the aid of a gas range. When the substantials had been disposed of and cigars and cigarettes were in evidence an hour or more of reminiscence, story and song was happily spent—set speeches were barred. The monarch of the table was President W. W. Scranton, who arrived home only a short while prior to the dinner, and he recounted many incidents related to his voyaging."

"B. L.," writing from Indianapolis, Ind., declares there is no doubt that Mount Vernon, Ind., will have an artificial gas plant in operation before the close of the year. The grantees have agreed to the proposition for a net rate not to exceed $1.25 per 1,000.

The Market for Gas Securities.

The net result of the trading in Consolidated gas for the week was a gain of 3 points. This morning (Friday) the opening figures were 125 to 125½. It need not surprise anyone if the stock goes to 150 before August 1st.

The last payment (50 per cent.) on the 1907 issue of convertible debentures by the New Haven (Conn.) Company is due now. The payment period expires the 1st prox. The sale by Special Master of the Fort Wayne (Ind.) natural gas properties was consummated the 16th inst. The successful bid ($750,000) was made by Mr. James N. Wallace, who represented the reorganization committee of the bondholders. Treasurer Lillies' statement, respecting the regular quarterly dividend on the U. G. I. Company's stock (2 per cent. payable the 15th prox.) recalls the thought that these shares are due for a marked rise. Something is underway that will send them up with celerity.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks

16 WALL STREET, NEW YORK CITY.

JUNE 22.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	125	125½
Central Union Gas Co.—				
1st 5's, due 1972, J. & J.	3,000,000	1,000	92	97
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	—	105
Mutual	3,500,000	100	130	160
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	92	96
New York & Richmond Gas				
Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	—	98	104
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	100	105
Con. 5's, due 1945, J. & J.	1,500,000	—	97	101
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	90	98
Standard	5,000,000	100	70	100
Preferred	5,000,000	100	100	125
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	100	105
The Brooklyn Union	15,000,000	1,000	112	130
1st Con. 5's, due 1948, M. & N.	15,000,000	—	91½	92
Yonkers	299,600	500	130	—
Out-of-Town Companies.				
Bay State	50,000,000	50	1	11-16
" Income Bonds	2,000,000	1,000	—	75
Binghampton Gas Works	450,000	100	—	65
" 1st Mtg. 5's	500,000	1,000	95	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
" " Bonds, 5's	a250,000	1,000	63	66
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed				
Gold Bonds	7,660,000	1,000	104	106¼
Cincinnati Gas and Electric				
Co.	29,500,000	100	89	90 x
Columbus (O.) Gas Co., 1st				
Mortgage Bonds	1,500,000	1,000	93	98
Columbus (O.) Gas Lt. &				
Heating Co.	1,682,750	100	87	88
Preferred	3,026,500	100	81	83
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	—	105
Mortgages, 6's	3,600,000	—	—	118
Chesapeake, 1st 6's	1,000,000	—	—	—
Equitable, 1st 6's	910,000	—	—	—
Consolidated, 1st 5's	1,490,000	—	—	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	—	—	100
Denver Gas and Electric	—	—	74½	75
Detroit City Gas Co.	6,000,000	50	—	50
" Prior Lien 5's	4,618,000	1,000	—	98
Detroit Gas Co., 5's	881,000	1,000	75	80
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co.,				
Chicago, Bonds	2,000,000	1,000	—	101
Essex and Hudson Gas Co.	6,500,000	—	39	40
ort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Lt. Co.,				
1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of				
New Jersey	10,500,000	—	100	105
" Bonds, 5's	10,500,000	—	101	102½
Indianapolis	2,000,000	—	60	70
" Bonds, 5's	2,650,000	—	104½	105
Jackson Gas Co.	250,000	50	82	—
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co.,				
of Missouri	5,000,000	100	—	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	—	100
Preferred	2,500,000	100	60	90
Bonds	10,000,000	1,000	104	104¼
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,370,000	50	143	145
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip,				
due 1910	100,000	25	60	60½
Massachusetts Gas Compan-				
ies, of Boston	25,000,000	100	54	54½
Preferred	25,000,000	100	85½	86
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	56	58
Bonds, 6's	6,000,000	—	137	138
New Haven	2,000,000	25	200	—
Peoples Gas Lt. & Coke Co.,				
Chicago	25,000,000	100	91¾	92
1st Mortgage	20,100,000	1,000	—	—
2d "	2,500,000	1,000	104	—
Rochester Gas & Elec. Co.	2,150,000	50	88	—
Preferred	2,150,000	50	118	—
Consolidated 5's	2,000,000	—	104½	105½
San Francisco, Cal.	15,500,000	—	—	—
St. Joseph Gas Co.—				
1st Mtg. 5's	751,000	1,000	92	—
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgages, 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	96¼	—
Syracuse, N. Y.	1,378,000	100	50	55
Bonds	2,047,000	1,000	102	—
Washington, D. C.	2,600,000	20	346¼	353
1st Mortgage, 6's	600,000	—	—	—
Western, Milwaukee	4,000,000	—	—	—
Wilmington, Del.	600,000	50	220	—

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DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO., N. W. CORNER BROAD AND ARCH STS., PHILADELPHIA, PA., June 10, 1908.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable July 15th, 1908, to stockholders of record at the close of business, June 30, 1908. Checks will be mailed.

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By thoroughly experienced man. Can erect and operate plant. Can also furnish best of references.

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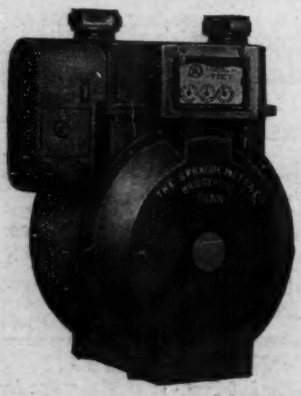

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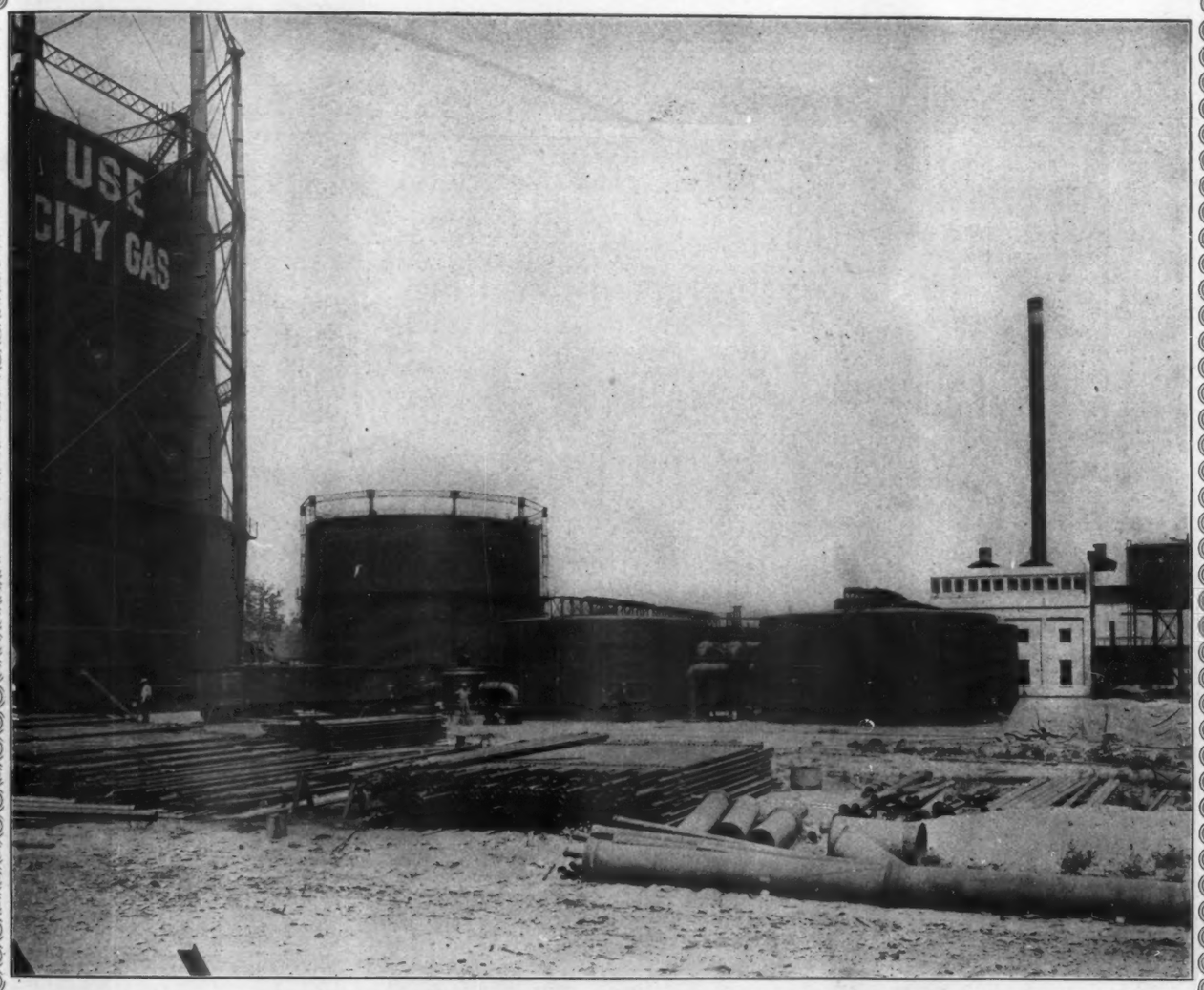

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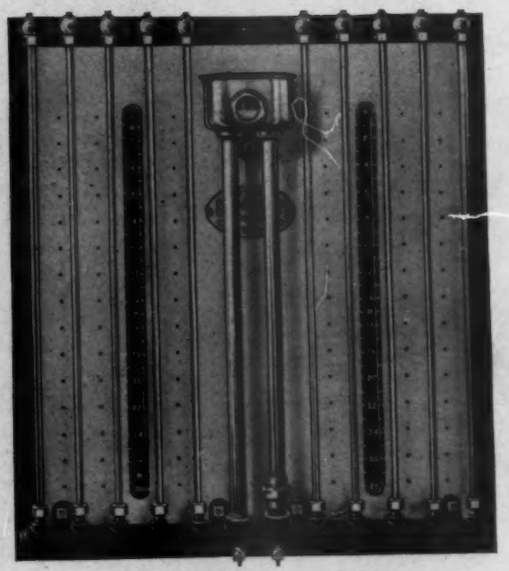

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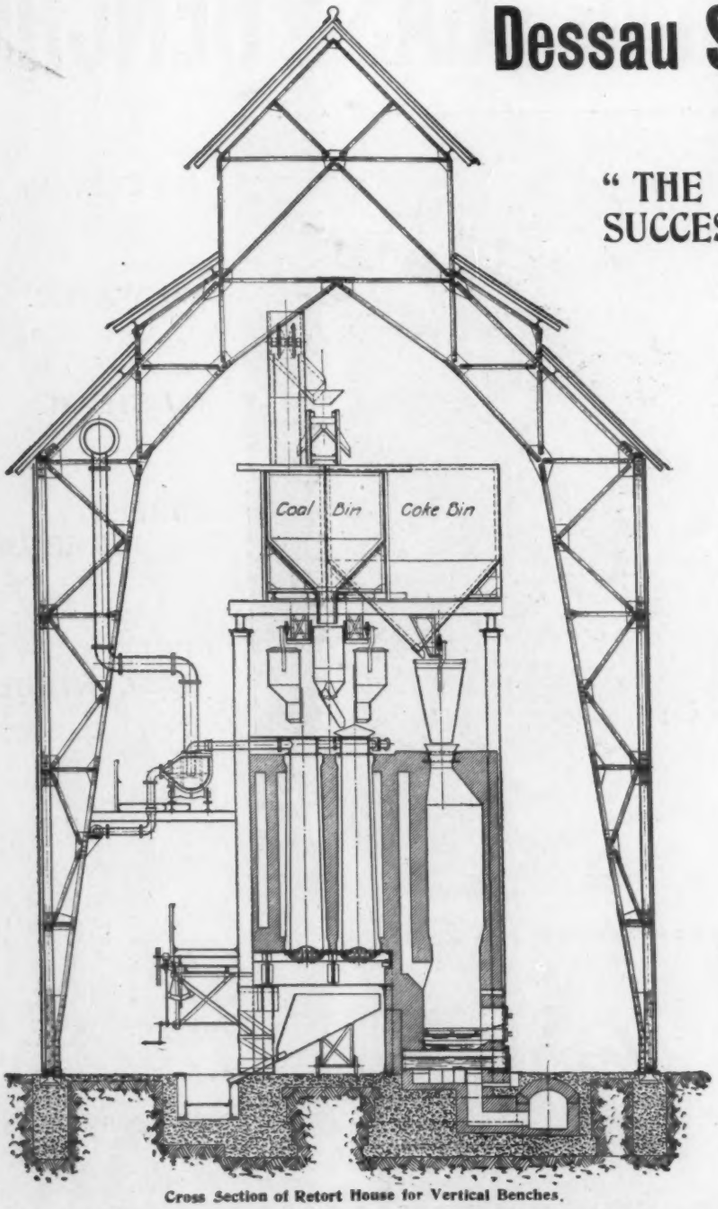
Dessau System of Vertical Retorts.

"THE ONLY SYSTEM IN SUCCESSFUL OPERATION."



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WHY NOT OBTAIN SIMILAR RESULTS AND INCREASE

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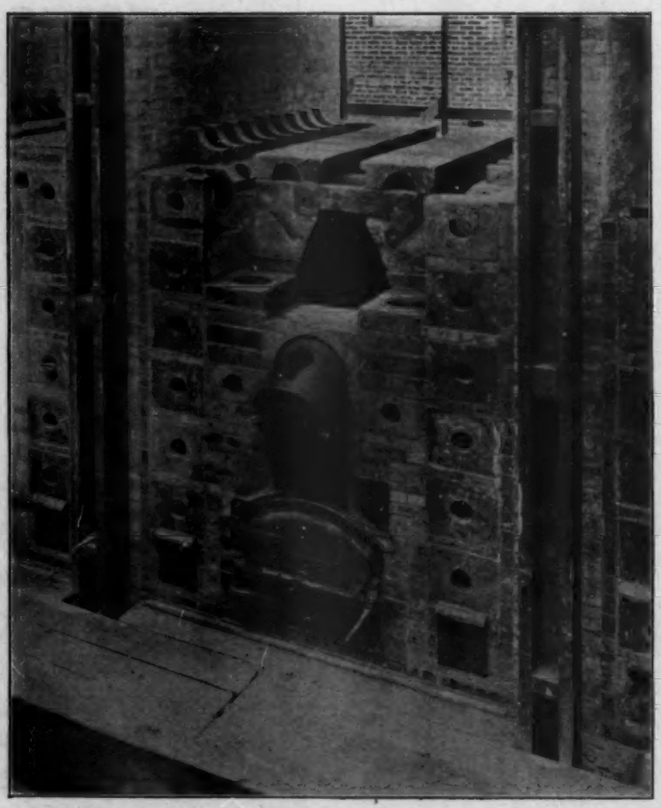

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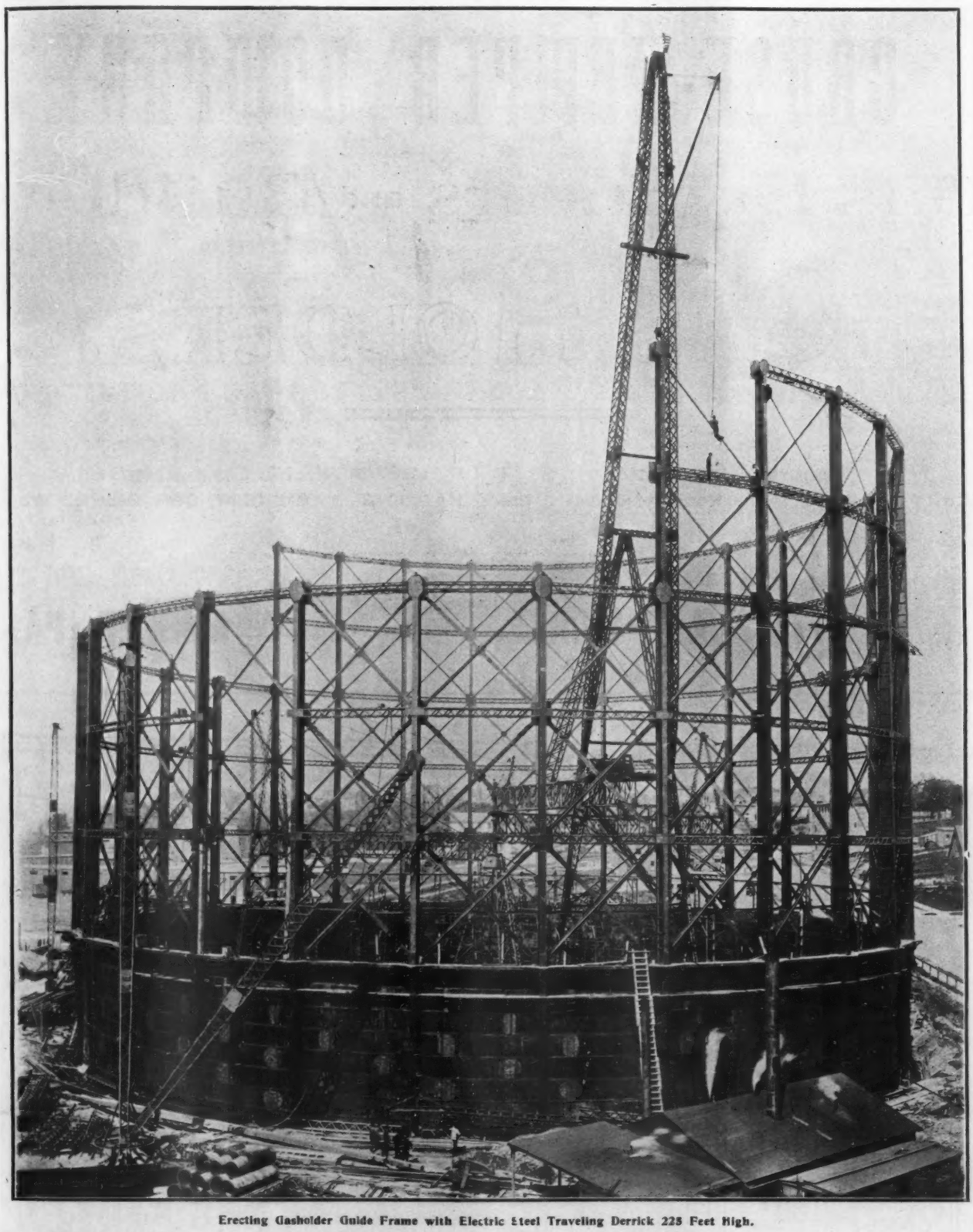

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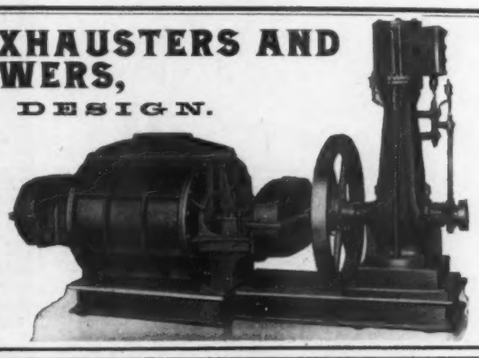

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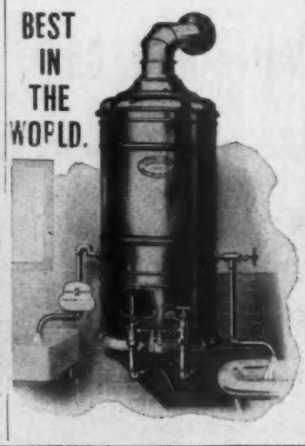

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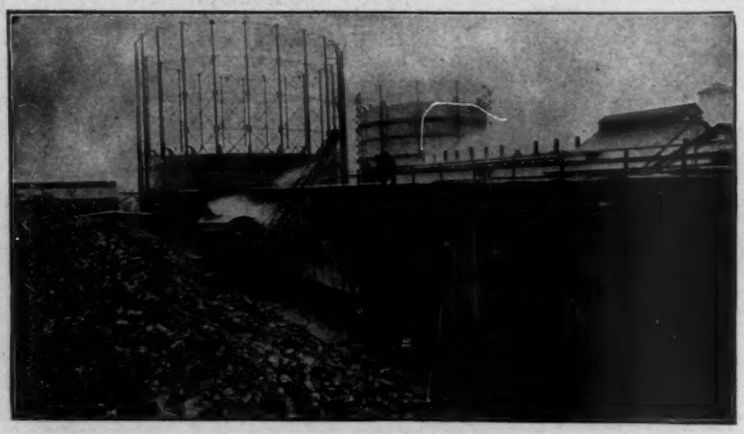

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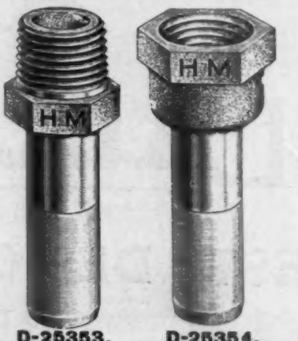

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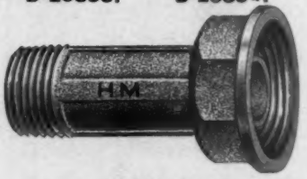

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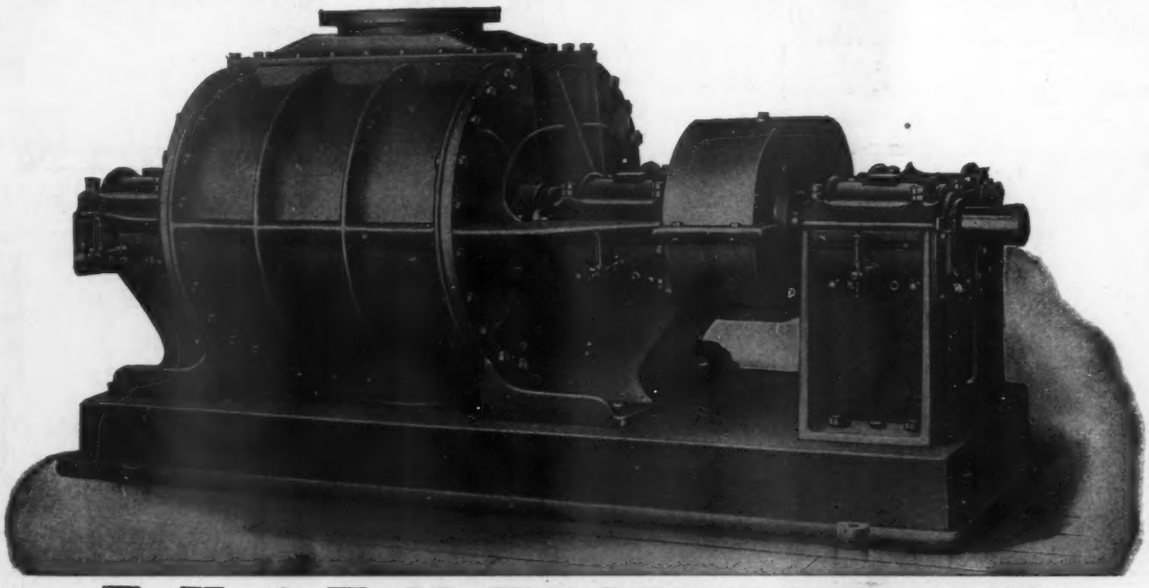

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PUBLIC LIGHTING TABLE.

JULY, 1908.

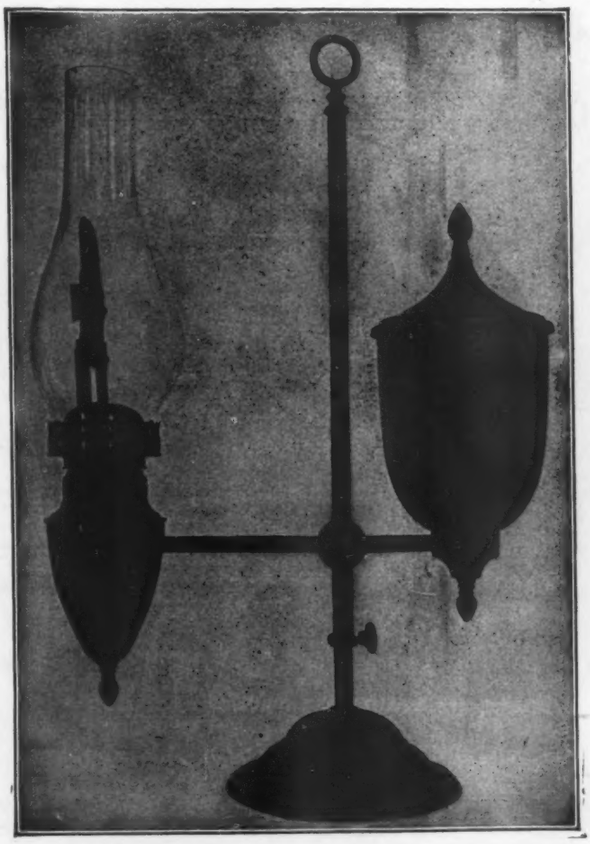
Table No. 1.
FOLLOWING THE MOON.

Day of Week.	Date.	Light.	Extinguish.
Wed.	1	8.00 PM	3.30 AM
Thu.	2	8.00	3.30
Fri.	3	9.50	3.30
Sat.	4	10.20	3.30
Sun.	5	10.40	3.40
Mon.	6	11.10 FQ	3.40
Tue.	7	11.40	3.40
Wed.	8	12.10 AM	3.40
Thu.	9	12.40	3.40
Fri.	10	1.20	3.40
Sat.	11	2.10	3.40
Sun.	12	No L.	No L.
Mon.	13	No L FM	No L.
Tue.	14	No L.	No L.
Wed.	15	8.00 PM	10.20 PM
Thu.	16	8.00	10.50
Fri	17	8.00	11.30
Sat.	18	8.00	12.00
Sun.	19	7.50	12.30 AM
Mon.	20	7.50 LQ	1.00
Tue.	21	7.50	1.30
Wed.	22	7.50	2.00
Thu.	23	7.50	2.40
Fri.	24	7.50	3.50
Sat.	25	7.50	3.50
Sun.	26	7.50	4.00
Mon.	27	7.50 NM	4.00
Tue.	28	7.50	4.00
Wed.	29	7.50	4.00
Thu.	30	7.50	4.00
Fri.	31	7.50	4.00

TOTAL HOURS DURING 1908.

By Table No. 1.

	Hrs.Min.
January	228.30
February	187.30
March	192.00
April	160.10
May	155.10
June	138.00
July	155.50
August	173.40
September	185.20
October	214.00
November	218.10
December	226.40
Total, yr.	2235.00



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2d. It is remarkably steady. Will burn 24 hours continuously with less than 2 per cent. variation.

3d. It is much less dangerous than Pentane, which is a kind of gasolene.

4th. It is not easily affected by air currents in the photometer room.

5th. Since the lamp may burn continuously, the candle power of gas may be taken at any moment, if necessary. This insures steady illuminating power without waste of carburetting material.

6th. The first cost of the lamp brings it within the reach of even small gas works.

7th. Costs much less to maintain than a Pentane lamp or sperm candles doing the same service.

8th. Is not affected by the weather.

PUBLIC LIGHTING TABLE.

JULY, 1908.

Table No. 2.
NEW YORK CITY.
ALL NIGHT LIGHTING.

Day of Week.	Date.	Complete Lighting in One Hour (From Time Given) P. M.	Complete Extinguishing in 50 Minutes (From Time Given) A. M.
Wed.	1	7.27	3.07
Thu.	2	7.22	3.07
Fri.	3	7.22	3.07
Sat.	4	7.22	3.07
Sun.	5	7.22	3.07
Mon.	6	7.22	3.07
Tue.	7	7.22	3.07
Wed.	8	7.22	3.07
Thu.	9	7.17	3.12
Fri.	10	7.17	3.12
Sat.	11	7.17	3.12
Sun.	12	7.17	3.12
Mon.	13	7.17	3.12
Tue.	14	7.17	3.12
Wed.	15	7.17	3.12
Thu.	16	7.12	3.17
Fri.	17	7.12	3.17
Sat.	18	7.12	3.17
Sun.	19	7.12	3.17
Mon.	20	7.12	3.17
Tue.	21	7.12	3.17
Wed.	22	7.12	3.17
Thu.	23	7.07	3.22
Fri.	24	7.07	3.22
Sat.	25	7.07	3.22
Sun.	26	7.07	3.22
Mon.	27	7.07	3.22
Tue.	28	7.07	3.22
Wed.	29	7.07	3.22
Thu.	30	7.02	3.27
Fri.	31	7.02	3.27

TOTAL HOURS DURING 1908.

	Hrs.Min.
January	481.50
February	329.15
March	351.50
April	341.50
May	233.05
June	218.10
July	282.55
August	254.55
September	292.25
October	420.45
November	374.30
December	411.05
	3992.35
Deduct on account of 50 min. extinguishing time	30.30
Total, yr.	3962.05

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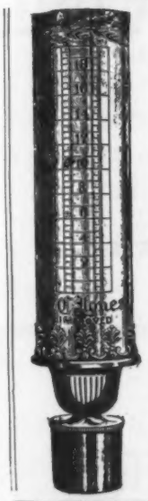

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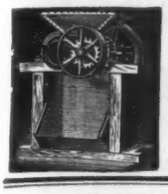

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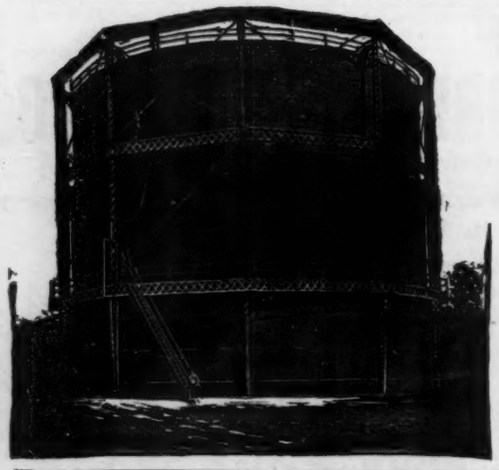

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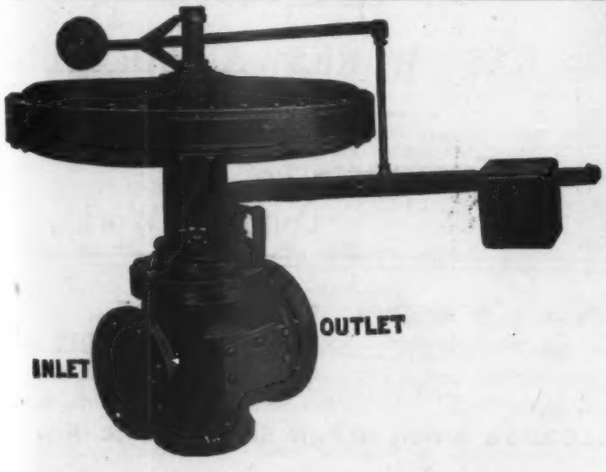

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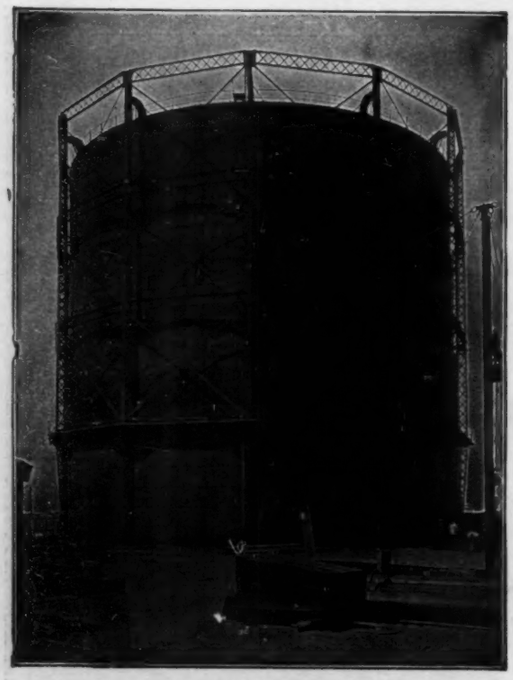

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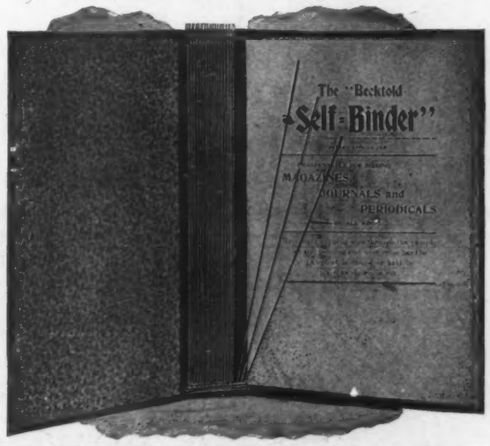

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